

Getting Dressed for Success: Implementing Health-Promoting mHealth in Swedish Child and School Healthcare Services

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”Livet måste levas framåt, men kan endast förstås bakåt”
Søren Kierkegaard

”Den mätta dagen, den är aldrig törst. Den bästa dagen är en dag av törst”
Karin Boye

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Abstract

Background: Implementing new interventions or new ways of working in welfare organizations is often challenging, even when their effectiveness is well established. This also applies to digital interventions, including mobile health (mHealth), which can support children's and adolescents' mental health and healthy lifestyle behaviors, but that have not yet become an established part of routine practice in child and school healthcare services in Sweden.

Aim: To generate knowledge about the implementation of mHealth interventions that support health promotion practices during routine health visits in Swedish child and school healthcare.

Studies: The thesis comprised four sub-studies, examining implementation during the preparation phase (Studies I and II) and the active implementation phase (Studies III and IV).

Study I used a qualitative design to explore organizational readiness for mHealth implementation in child and school healthcare. Interviews were conducted with nurses, managers, and policymakers, and analyzed using inductive content analysis. Readiness was perceived as having trusting conditions for implementation. The capability to manage the health-related data generated by mHealth, together with governance at national, regional, and local levels, emerged as dealbreakers for readiness. Alignment between mHealth and current ways of working, along with camaraderie within teams, were also identified as important aspects of readiness.

Study II employed a quantitative prospective observational design to assess six dimensions of organizational readiness, reflecting different aspects of preparedness and conditions for implementing mHealth among child healthcare nurses prior to implementation, and to examine their association with nurses' subsequent mHealth adoption. Data on the six readiness dimensions were collected through questionnaires, and adoption data were retrieved from the mHealth child healthcare interface. Analyses included Rasch analyses, descriptive statistics, and regression-based methods. Nurses reported varying degrees of readiness across dimensions, however, none were significantly associated with adoption. Higher degrees of collegial readiness showed indications of potential relevance for adoption.

Study III used a qualitative design to explore high school students' perceptions of determinants influencing their adoption of a recommended mHealth tool during health visits. Data were collected through interviews and analyzed using inductive content analysis. The decision to adopt mHealth was shaped by students' developmental stage and involved balancing personal

beliefs with influences from peers and adults. Students emphasized the importance of alignment between the mHealth tool and their individual beliefs and experiences. Determinants also extended beyond the individual and the technology itself, underscoring the importance of raising awareness outside the health visit, as well as the presence of responsive and supportive adults within the school environment.

Study IV employed a qualitative design with cross-case comparisons to investigate similarities and differences in implementation determinants across five schools with varying mHealth adoption levels. Determinants were explored through interviews with nurses and principals, and adoption was assessed through students' charts. Most determinants were similarly manifested across schools. However, schools with higher adoption levels were characterized by stronger principal engagement, closer alignment between the mHealth intervention and student population needs, and clearer perceived regional guidance. While the implementation process was generally student-centered, the highest adopting-school also conducted systematic cross-professional implementation activities and exhibited an organizational culture aligned with the intervention.

Conclusions: mHealth implementation is influenced by multilevel contextual factors across both inner and outer contexts. Some factors influence the entire process, while others are particularly decisive during the preparation phase. In this phase, organizational readiness is perceived as the presence of trusting conditions, where the ability to manage health-related data and clear governance structures act as dealbreakers for achieving readiness. Although the findings do not provide evidence of an association between organizational readiness and implementation outcomes, they indicate a trend suggesting that collegial readiness may relate to higher levels of implementation outcomes. Governance needs remain central throughout the implementation process and are strongly affected by the structural complexity of child and school healthcare services. Implementing mHealth within health visits alters routines beyond individual nurses and requires collective efforts both among nurses and across professional groups. The implementation involves a complex structural and social alignment between the intervention and the organizations, professionals, and end-users. Finally, end-users are central agents in implementation, shaping both the implementation process and its outcomes and their adoption of mHealth requires multifaceted, life-stage-tailored strategies that extend beyond individual health visits. Overall, mHealth implementation can be understood as a co-implementation process between end-users and professionals.

Populärvetenskaplig sammanfattning

Bakgrund: Att implementera nya arbetssätt i välfärdsorganisationer är ofta utmanande, även när de har visat god effekt i forskning. Det gäller även digitala verktyg såsom mobil hälsa (mHälsa), som kan främja barns och ungas levnadsvanor och den psykiska hälsan, men som ännu inte är en del av det ordinarie arbetet inom barnhälsovården och elevhälsan. Det finns därför behov av mer kunskap om hur hälsofrämjande mHälsa-verktyg kan implementeras och bli ett naturligt stöd i det dagliga arbetet inom dessa verksamheter.

Barns och ungas hälsa påverkar inte bara hur de mår här och nu, utan också deras framtida hälsa, utbildning, arbetsliv och livsvillkor, och därmed samhällets utveckling på lång sikt. Samtidigt står många barn och unga inför hälsoutmaningar. Förekomsten av övervikt och obesitas bland 5–19-åringar har mer än fördubblats globalt sedan 1990, och i Sverige hade 11 procent av fyraåringarna övervikt eller obesitas år 2022. Parallellt har psykiska besvär ökat kraftigt. I en nationell undersökning från 2021 rapporterade 77 procent av svenska 15-åriga flickor och 46 procent av pojkarna återkommande psykosomatiska symtom, såsom huvudvärk, magont eller sömnsvårigheter. Denna utveckling gör tidiga hälsofrämjande insatser viktiga. Barnhälsovård och elevhälsa har här en unik roll eftersom de möter nästan alla barn och unga, oavsett bakgrund. Genom återkommande strukturerade hälsobesök, från födseln till och med gymnasiet, arbetar barnhälsovårdssjuksköterskor och skolsköterskor med att främja goda levnadsvanor, stärka psykisk hälsa och upptäcka tidiga tecken på ohälsa. Digitala verktyg, som mHälsa, kan komplettera detta arbete genom att, till exempel, öka tillgängligheten och erbjuda stöd även mellan besöken. Forskning visar att mHälsa kan bidra till förbättrade levnadsvanor och en stärkt psykisk hälsa hos barn och unga. Men trots detta används mHälsa i begränsad omfattning i det dagliga arbetet inom barnhälsovård och elevhälsa. Utmaningen handlar således inte enbart om att utveckla välfungerande digitala stöd, utan också om att förstå hur de kan implementeras i verksamheterna. Mot denna bakgrund var syftet med avhandlingen att generera kunskap om implementering av mHälsa som stöd i det hälsofrämjande arbetet under hälsobesök inom svensk barnhälsovård och elevhälsa.

Delstudier: Avhandlingen bestod av fyra delstudier som tillsammans undersökte implementering både under förberedelsefasen, då verksamheten tar ställning till och planerar för en implementering (Studie I–II), och under den aktiva implementeringsfasen, då mHälsa har börjat användas i praktiken under hälsobesök (Studie III–IV).

Delstudie I var en intervjustudie med sköterskor, chefer och beslutsfattare inom barnhälsovård och elevhälsa. Studien utforskade deras uppfattningar om vad som gör en verksamhet redo att implementera mHälsa, det vill säga dess organisatoriska beredskap för förändring. För deltagarna handlade beredskap om att känna trygghet till de förutsättningar som behövs för att implementeringen ska fungera. Två förutsättningar uppfattades särskilt avgörande för att verksamheten skulle vara redo: 1) att kunna lagra den hälsodata som mHälsa genererar, och 2) att få tydlig vägledning om att mHälsa ska användas och hur införandet ska gå till, från nationell och regional nivå, samt från den närmaste chefen. Det påverkade också hur väl mHälsa passade ihop med verksamhetens befintliga arbetssätt, såsom mål, rutiner, värderingar och kultur, samt om arbetsgruppen hade en god teamkänsla och ett gott samarbete.

Delstudie II undersökte den organisatoriska beredskapen inom barnhälsovården, med fokus på hur redo verksamheterna var att börja använda mHälsa, och om beredskapen hade samband med hur mycket verktyget användes under hälsosamtal de följande 19 veckorna. Beredskapen mättes med en enkät där barnhälsovårdssjuksköterskorna bedömde sex olika aspekter av organisatorisk beredskap. Resultaten visade att graden av beredskap varierade mellan aspekterna, men att ingen av dem hade ett statistiskt säkerställt samband med hur mycket mHälsa användes. Däremot sågs en tendens till högre användning hos de sköterskor vars arbetsgrupper arbetade tillsammans med att diskutera och anpassa rutiner, arbetsuppgifter och ansvar i samband med implementeringen.

Delstudie III var en intervjustudie med gymnasieelever. Den utforskade deras uppfattningar om faktorer som påverkar att elever börjar använda mHälsa-verktyg efter en rekommendation i samband med ett hälsobesök. Elevernas beslut att använda mHälsa beskrevs som starkt präglad av deras livsfas; en period där de aktivt formar sin identitet och sina personliga preferenser, inklusive sin inställning till att använda mHälsa för att stötta sin hälsa. I denna process balanserade de sina egna åsikter mot inflytande från jämnåriga och vuxna. Beslutet att använda mHälsa påverkades av hur väl verktyget stämde överens med eleverna själva, såsom deras behov, tilltro till mHälsa och hur de uppfattade verktygets design och funktioner. Eleverna betonade dessutom vikten av ökad medvetenhet om verktyget även utanför hälsobesöket, gärna genom diskussioner med andra elever, samt betydelsen av ett stödjande skolklimat med lyhörda vuxna.

Delstudie IV undersökte varför vissa gymnasieskolor använde mHälsa mer än andra. Studien jämförde fem skolor och kombinerade intervjuer med skolsköterskor och rektorer med data över hur mycket verktyget faktiskt användes under hälsosamtalen. De flesta faktorer som påverkade

implementeringen var lika mellan skolorna, både mellan de som använde mHälsa mer och de som använde det mindre. Men tre faktorer skiljde ut de skolor som hade högre användning: 1) ett starkare engagemang från rektor, 2) att mHälsa-verktyget upplevdes passa bättre ihop med skolans elevers behov och resurser, och 3) tydligare upplevelser av regional vägledning. På alla skolor var implementeringsarbetet i hög grad elevcentrerat, och många aktiviteter syftade till att öka elevers kännedom om verktyget. Den skola som lyckades bäst stack dock ut genom att arbeta mer systematiskt och samarbeta mellan flera yrkesgrupper för att stötta implementeringen av verktyget. Denna skola hade också en organisationskultur som passade särskilt väl ihop med det aktuella verktyget.

Slutsats: Tillsammans visar studierna att implementering inte bara handlar om att lägga till ett nytt digitalt verktyg under ett hälsosamtal. Det är snarare en större förändringsprocess där faktorer på flera nivåer, både inom och utanför barnhälsovårdens och elevhälsans organisationer, påverkar hur mHälsa implementeras. Vissa faktorer är betydelsefulla genom hela processen, medan andra är särskilt viktiga i förberedelsefasen när verksamheten ska ta ställning till om och hur mHälsa ska införas. Verksamheterna beskrev sig som redo för implementering när de upplevde trygghet i att förutsättningar för implementering fanns på plats. Två förutsättningar var avgörande för att vara redo för implementering: förmågan att lagra den hälsodata som mHälsa genererar, samt tydlig vägledning på nationell och regional nivå, och från närmaste chefen. Avhandlingen visar inget tydligt samband mellan organisatorisk beredskap och hur väl implementeringen lyckades, men resultaten tyder på att implementeringen fungerar bättre när kollegor tillsammans diskuterar och tar ansvar för det nya arbetssättet. Behovet av vägledning kvarstår genom hela implementeringsprocessen och påverkas av de komplexa organisationsstrukturer som barnhälsovård och elevhälsa är en del av. Studierna visar också att implementering av mHälsa innebär förändringar som sträcker sig bortom den enskilda sköterskans möte med familjer eller elever. Implementeringen karaktäriseras därför av ett gemensamt arbete, både mellan sjuksköterskor och mellan olika professioner, för att utveckla rutiner för implementering, men även för att stötta det individuella lärandet kring mHälsa-verktyget. Hur väl implementeringen fungerar påverkas också av hur väl mHälsa-verktyget passar ihop med verksamhetens kultur, mål, rutiner och värderingar, liksom med professionernas arbetssätt samt slutanvändarnas behov och resurser. Slut användarna är inte bara mottagare av mHälsa, utan också aktiva medskapare av implementeringsprocessen och deras vilja att använda verktyget präglas av deras livsfas och sociala sammanhang. Därför behöver strategier för att stödja användning anpassas till slut användarnas bredare kontext, och inte enbart till tekniken eller det enskilda hälsobesöket.

List of papers

- I. **Fagerström M**, Löf M, Müssener U, Thomas K. (2023). The importance of trusting conditions for organizations' readiness to implement mHealth to support healthy lifestyle behaviors: An interview study within Swedish child and school healthcare. *Digital Health*, 9, 20552076231181476, <https://doi.org/10.1177/20552076231181476>. *Published under CC BY license.*
- II. **Fagerström M**, Lundgren M, Löf M, Melin J, Neher M, Nyström Delisle C, Thomas K. Exploring organizational readiness for the early adoption of a digital obesity prevention program in Swedish child healthcare: An observational prospective study. *Submitted to BMC Health Services Research, 2025.*
- III. **Fagerström M**, Löf M, Müssener U, Neher M, Nutley S.B., Thomas K. (2025). What makes high school students use a mobile app to promote mental health? An interview study in Sweden. *School Mental Health*, 17, 1026-1040. <https://doi.org/10.1007/s12310-025-09795-6>. *Published under CC BY license.*
- IV. **Fagerström M**, Löf M, Müssener U, Neher M, Varsi, S, Thomas K. Determinants for the implementation of a mobile-based mental health tool: A qualitative cross-case study of five Swedish high schools using the CFIR framework. *Submitted to BMC Public Health, 2026.*

Abbreviations

App	Mobile Application
CFIR	Consolidated Framework for Implementation Research
DSI	Det Syns Inte
mHealth	Mobile Health
MINISTOP	Mobile Based Intervention Intended to Stop Obesity in Preschoolers
MIP	Mobile Implementation Project
ORC	Theory of Organizational Readiness for Change
SMS	Short Message Service
TMF	Theories, Models and Frameworks
WHO	World Health Organization

Preface

In the mid-2000s, I graduated as a physiotherapist. Armed with newly acquired knowledge but entering the profession at a time when the job market was challenging, I spent my first years working in several different healthcare settings and with a variety of patient groups. In these roles, I encountered different organizational structures, diverse professional and organizational cultures, varying leadership styles, and several ways of organizing work within politically governed welfare services. I was struck by how different it could be to work in units sometimes separated only by a corridor, and how these differences shaped the possibilities for providing good care.

As the job market gradually stabilized, I focused my clinical work on the rehabilitation of patients with neurological conditions. As a physiotherapist, I was expected to stay up to date with emerging knowledge and to integrate evidence-based practices into everyday work. In addition to my clinical work, I also served as a project manager, leading an implementation initiative. Through these experiences, I realized, both with surprise and fascination, how challenging it can be to implement new knowledge in practice, even when the evidence is strong. I often found that the motivation to improve care was high, yet expectations for change were frequently shaped by a simplified view that change is “just a matter of starting to do things differently”. A great deal of responsibility is often placed on individual staff members to shift from old to new ways of working, while broader organizational structures and contextual conditions are not always acknowledged or addressed.

These experiences deepened my interest in what shapes everyday work in healthcare settings. After meeting my main supervisor, Kristin Thomas, I was given the opportunity, through this doctoral work, to further explore the field of implementation science and the complexity arising from interactions between individuals, organizations, and the practices or interventions being implemented. I hope that the findings of this thesis will contribute to a greater understanding of the complexity of implementation processes and inspire and support the development of structures that enable sustainable improvements in healthcare.

Introduction

The national goal of Sweden's public health policy is to establish societal conditions that promote good and equitable health across the entire population¹. Many health-related behaviours, such as dietary habits, are established early in life and have a lasting influence on health across the life course². This makes early health-promoting efforts especially valuable, both for the individual's long-term health and for the population's future public health¹⁻⁴. In this regard, child and school healthcare services play a crucial role, reaching the majority of children and adolescents during formative years, irrespective of socioeconomic background⁵⁻⁷. A key component of national health promotion is the routine health visits conducted by child and school healthcare nurses at regular intervals from birth through high school, that aim to monitor development and support health, including mental health and healthy lifestyle habits among children and adolescents^{6, 8}.

Today, children and adolescents face significant health challenges. Overweight and obesity have developed into a global public health concern, and the World Health Organization (WHO) reports that the global prevalence among children and young people aged 5–19 has more than doubled since 1990, increasing from 8% to a 20% in 2022⁴. In Sweden, approximately 11% of all four-year-olds had overweight or obesity in 2022, with indications of a socioeconomic gradient, suggesting unequal health development already in early childhood⁹. In parallel, mental health problems among adolescents have increased remarkably³. National data show that the proportion of fifteen-year-olds who regularly report psychosomatic complaints, such as headache, stomachache or sleeping difficulties, has increased substantially since the 1980s¹⁰. In a 2021 report, 77% of girls and 46% of boys reported such complaints at least twice a week, representing more than a doubling since the 1980s¹⁰. This underscores the need for effective, equitable, and accessible health-promoting interventions that can reach children and young people early and on a broad scale.

Over the past decades, increasing digitalisation has created new opportunities to address these public health challenges. Mobile phones are now a common part of everyday life for most young people and parents, providing a platform for health-promoting interventions that are accessible, relatively scalable, and can be integrated into daily routines¹¹. Significant research resources have been invested in the development and evaluation of mobile-based interventions (mHealth), and evidence shows promising effects on

healthy lifestyle behaviours and mental health among children and adolescents¹²⁻¹⁶. mHealth therefore emerges as a relevant and potentially powerful tool for strengthening health-promoting efforts within child and school healthcare services.

Despite this potential, mHealth interventions are still implemented to a limited extent within healthcare^{17, 18} and are not yet routine in child and school healthcare services. This highlights a clear gap between research-based knowledge and actual use in practice. Translating research evidence into routine clinical practice has long been recognized as a major challenge, with well-cited classic studies indicating that it takes on average 17 years for research to be used in clinical practice^{19, 20}; a timeline that, in the context of mobile phone development, traces back to around 2009, a couple of years after the first smartphone was introduced²¹. This recurring challenge has contributed to the emergence of implementation science as a distinct research field, which seeks to generate knowledge on how to bridge this gap^{22, 23}, by systematically examining contextual factors influencing implementation, understanding implementation processes, and evaluating implementation outcomes in complex, real-world contexts beyond controlled research trials²⁴.

Indeed, there has been research on the implementation of mHealth interventions²⁵⁻²⁹. However, these studies have primarily focused on mHealth tools targeting adult populations within healthcare or primary care settings. Moreover, they have often emphasized the technology itself, or factors related to individual clinical professionals²⁵⁻²⁹. While these perspectives are important, such a focus may overlook broader contextual factors that influence implementation. This gap of knowledge means that many children and adolescents may not receive potentially effective interventions that may promote their health in both the short and long term (Figure 1), while also contributing to increasing societal costs over time. Against this background, this thesis sought to investigate the implementation of health-promoting mHealth specifically within child and school healthcare.

In the four included studies, the implementation of mHealth was investigated using three examples of interventions:

- **LIFE4YOUth**³⁰, which aims to support healthy lifestyle behaviours among high school students.
- **MINISTOP** (Mobile Based Intervention Intended to Stop Obesity in Preschoolers)^{31, 32}, targets healthy lifestyle behaviours in preschool children.
- **On the Inside** (Swe: *Det Syns Inte*, DSI)³³, which focuses on mental health promotion among high school students.

The thesis adopts a multi-level contextual approach by examining implementation from multiple perspectives, including mHealth policymakers, managers within child and school healthcare, child and school healthcare nurses, as well as end-users of mHealth. Furthermore, it includes studies examining implementation processes during both the preparation phase, that is, prior to or in the early stages of the implementation, and during the active implementation phase, when the intervention has begun to be used.

The results of this thesis provide insights that may: 1) highlight implementation aspects that mHealth developers, researchers and clinicians may consider when designing mHealth interventions, 2) inform implementation strategies for health-promoting mHealth in child and school healthcare, and 3) offer insights for national-level policymakers to support the implementation of mHealth; ultimately contributing to improved access to evidence-based, health-promoting mHealth interventions for children and adolescents.

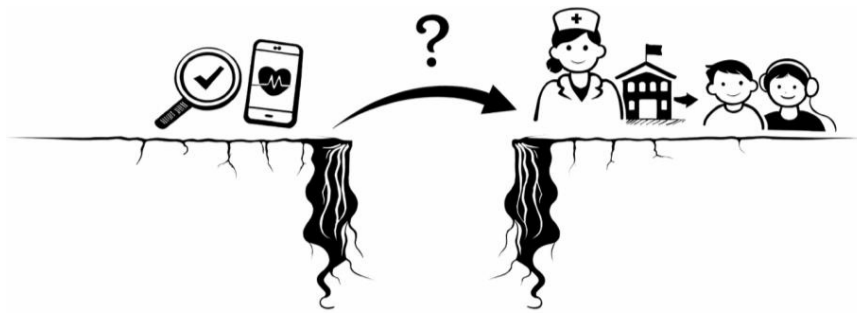


Figure 1. Illustration of the knowledge gap that underpins the aim of this thesis. Image generated with AI (ChatGPT, 2026).

Background

This chapter positions the thesis within a broader context. It begins by providing an overview of implementation science as a research discipline. Following this, it outlines perspectives on health promotion and disease prevention. Finally, it introduces mHealth by defining the concept, presenting evidence of its potential to promote health among children and adolescents, and describing current research on mHealth implementation.

Overview of Implementation Science

Origins and Development

Implementation science emerged in response to the evidence-based movement during the 1990s^{22, 34}. This movement presented a paradigm shift in healthcare, emphasizing an increased use of research-based knowledge and evidence-based practices^{22, 23, 34}. However, it soon became apparent that research findings were not being translated as widely or rapidly as expected^{22, 34, 35}, which became the starting point for the development of implementation science^{22, 23}.

Implementation science has been defined in various ways, though most definitions share common elements with the one presented in the launch edition of “Implementation Science” in 2006, the first journal dedicated to the field³⁶. There, it was defined as *“the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services. It includes the study of influences on healthcare professional and organizational behavior”*³⁷. The term implementation science is often used interchangeably with implementation research and is closely related to several other research areas that share similar goals and concepts, such as knowledge translation, knowledge transfer, knowledge exchange, and knowledge integration^{22, 34}.

Although the launch of the journal Implementation Science is often considered the formal beginning of the research field, challenges related to implementation have long been recognized. As a result, the field has strong ties to several other disciplines and traditions, including behavioural science, policy implementation, sociology, psychology, and organizational science^{22-24, 34}. The field borrows concepts, theories, models, and frameworks from these areas to

better understand implementation^{23, 36}. It has also been strongly influenced by innovation research, particularly how innovations spread within society^{22, 23, 36}.

The implementation science field has evolved over time³⁴. Early research was primarily exploratory, aiming to define key concepts and establish a shared language and understanding through the development of theories, models, and frameworks. As the field matured, focus expanded to identifying barriers and facilitators to implementation and to designing strategies to support implementation. Building on this foundation, later work has further refined existing concepts and frameworks, with the goal of establishing more consistent terminology. These efforts have also contributed to the development of measurement instruments for assessing different aspects of implementation. More recently, research has increasingly examined the effectiveness of implementation strategies and the mechanisms through which they influence outcomes³⁴. Implementation science has also been introduced into the school context, where the conditions differ from those in healthcare, for example through organizational structure and mission, staff composition, and the influence of the school year^{38, 39}.

Theories, Models and Frameworks within Implementation Science

Implementation studies frequently use a broad range of theories, models, and frameworks (TMFs), which serve several important functions for research, such as clarifying assumptions, increasing transparency and helping to structure the complexity of implementation^{40, 41}. TMFs also provide shared definitions and terminology that enable clearer communication and comparison across studies, thereby strengthening the evidence-base and advancing implementation science as a field^{40, 42}.

To navigate the large number of TMFs within implementation science (143 identified by 2023⁴³), Nilsen⁴¹ in 2015 proposed a taxonomy that groups TMFs into three main categories based on their purpose; 1) process models, which guide the steps of the implementation process, 2) theories and determinant frameworks, which aim to explain and understand implementation outcomes and 3) evaluation frameworks, which specify implementation outcomes to be assessed. The TMFs used in this thesis are presented in a subsequent chapter of the cover story.

Specifically, determinant frameworks provide structured “lists” of factors, referred to as determinants, that influence implementation outcomes. Although the terminology varies across frameworks, they tend to highlight similar themes, and in other words, reflect a shared understanding of the key determinants that

influence implementation outcomes^{41, 44}. These determinants are presented in the following section.

Foundational Concepts

This section presents foundational concepts of implementation science.

Determinants for Implementation

Commonly identified determinants can be organized into five main categories⁴⁴ (Figure 2), each of which is described below. These determinants include factors that may function either as barriers (i.e., hindering factors) or facilitators (i.e., enabling factors), and that together influence whether, for example, a program or intervention, is successfully put into practice.

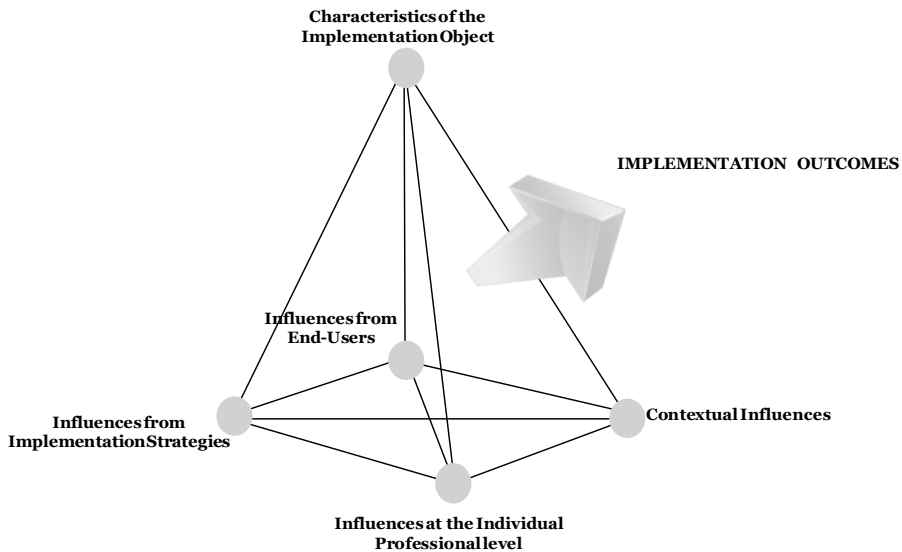


Figure 2. General determinants for implementation⁴⁴. Modified and reprinted with permission of Per Nilsen.

Characteristics of the Implementation Object

The implementation object refers to the “thing”⁴⁵ being implemented, which can be described as an idea that is perceived as new to an individual or organization^{46, 47}. In the literature, a range of terms are used to describe this object, such as policies⁴⁸, interventions⁴⁹, innovations⁵⁰⁻⁵³, evidence⁵⁴, evidence-based practice⁴⁸, program⁴⁸, or services^{41, 55}. In this thesis, the terms innovation, tool, program, and intervention are used interchangeably. Importantly, whatever form the object takes, it represents a practice that practitioners are

expected to carry out, use, or integrate into their routine work. Thus, although it is referred to as a “thing,” implementation science is primarily concerned with the enactment and use of this object in real-world practice rather than with the object itself.

Many determinant frameworks draw on the *Diffusion of Innovations* theory^{46, 47} to explain how the characteristics of the implementation object influence implementation outcomes²³. This theory posits that certain attributes of an innovation influence its adoption. These include its *relative advantage* (perceived benefit over existing practices), *compatibility* (alignment with users’ needs, values, and prior experiences), *complexity* (ease of use), *trialability* (ability to test on a small scale) and *observability* (visibility of results). Another aspect related to the implementation object is its *adaptability*, that is, the extent to which the innovation can be modified to fit both the organization and end-users, i.e., the target population of the innovation. High adaptability increases the likelihood of successful implementation, but on the other hand, removing or altering core function of the innovation may reduce its effectiveness; a tension referred to as the adaptability–fidelity dilemma in implementation science^{56, 57}.

Influences at the Individual Professional Level

At their core, organizations are made up of individuals, meaning that organizational change may be viewed as ultimately driven by individual behaviour change⁴⁹. Greenhalgh et al.³⁵ emphasize this point, noting that; *“People are not passive recipients of innovations. Rather (and to a greater or lesser extent in different persons), they seek innovations, experiment with them, evaluate them, find (or fail to find) meaning in them, develop feelings (positive or negative) about them, challenge them, worry about them, complain about them, “work around” them, gain experience with them, modify them to fit particular tasks, and try to improve or redesign them - often through dialogue with other users”*.

During implementation, individuals typically assume different roles. Some are responsible for using or delivering the intervention, commonly referred to as adopters^{35, 47}, recipients⁵³, users²⁴, or innovation deliverers⁵⁰. Others have leadership roles, including opinion leaders, formal managers or implementation leads⁵⁰⁻⁵³. Individuals play an influential role for implementation outcomes through their knowledge, beliefs, motivation, attitudes, values, prior experiences, views, self-efficacy and perceived need⁵⁰⁻⁵³.

Contextual Influences

Context refers to circumstances surrounding an implementation effort. The term *context* traces back to Latin *cum* and *texere*, meaning “with”/ “together” and “to weave” respectively⁵⁸. Thus, in other words, when an innovation is implemented, it becomes interwoven with the organization. Although the concept lacks a unified definition^{58, 59}, a commonly shared view is that context consists of active and dynamic factors that interact with the intervention. Rather than serving as a passive backdrop for implementation, context actively shapes implementation outcomes⁴⁹.

Contexts are often categorized into inner and outer context⁴⁹⁻⁵³. The inner context typically includes factors within the organization where the innovation is being implemented, such as structural conditions, social relations, organization support, leadership, and culture (i.e., norms, values, and basic assumptions⁴⁹)⁴⁹⁻⁵³. The outer context refers to factors external to the organization, such as economic conditions, political decisions, and the broader social landscape⁴⁹⁻⁵³.

Contextual Influences: Organizational Readiness

While context refers to the broader conditions surrounding an implementation effort, organizational readiness represents a more specific aspect of the inner context: the extent to which an organization is prepared to carry out an upcoming change^{60, 61}. Although the concept is used in different ways across the literature, it generally refers to whether the conditions within the inner context that are required for implementation are in place⁶². These include structural conditions, such as leadership engagement, availability of resources, or staff access to knowledge and information, as well as psychological conditions, such as perceived priority and confidence among staff to carry out the change⁶².

In implementation science literature, organizational readiness is described both as a determinant and as a construct integrated into determinant frameworks⁴⁹. The concept originates from early change management research on resistance to change in the 1940s^{63, 64}. Building on these foundations, Armenakis et al.⁶³, in 1993, conceptualized organizational readiness for change as a precursor to successful implementation. Since then, several definitions have been proposed, somewhat differing in terminology and conceptualization, but sharing elements with Armenakis’ original definition⁶⁰. One of the most widely used definitions within implementation science is Weiner’s⁶¹ formulation from 2009: “*the extent to which organizational members are psychologically and behaviourally prepared to implement a change*”. This definition highlights readiness as a collective psychological state, that reflects the shared willingness and perceived ability of organizational members to implement a specific

change⁶¹. Later research suggest that readiness should not be viewed as a static state that matters only prior implementation, but a dynamic construct that can change throughout the implementation process, hence, getting ready for the next step in the implementation⁶⁵.

Nevertheless, previous research has repeatedly identified conceptual challenges related to organizational readiness. For example, the term is used interchangeably with other terms, such as commitment, preparedness, acceptance, or resistance to change, and overlaps with related concepts such as facilitators/barriers and needs^{60, 62, 66}. It has been suggested that this lack of consensus may stem from the fact that the term “readiness” originates from words used in everyday language such as “being ready”, which can create an implicit assumption of shared meaning⁶⁰. Additionally, although the literature commonly emphasizes readiness as a key factor for implementation success and the intuitive assumption that higher readiness should lead to better outcomes, empirical evidence supporting this relationship is limited^{62, 65, 67}.

Influences from Implementation Strategies

Implementation strategies represent the “how-to” for overcoming implementation barriers to integrate an implementation object into routine practice⁶⁸ and are sometimes referred to as implementation interventions⁶⁹. A widely cited definition describes strategies as “*methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical program or practice*”⁶⁹.

Implementation strategies can be discrete, involving single standalone methods, or multifaceted, combining two or more discrete strategies⁶⁸. To facilitate comparisons of strategies across studies, several taxonomies have been developed⁷⁰. One of the most influential is the Expert Recommendations for Implementing Change (ERIC) project, which established standardized nomenclature and definitions for 73 discrete strategies through a systematic review and expert consensus approach^{71, 72}. These strategies were later organized into nine thematic clusters⁷³ and have also been adapted for school settings⁷⁴. Research shows that multifaceted strategies tend to be more effective than single strategies^{75, 76}, with their impact primarily observed on service-level outcomes within organizations, while evidence for patient-level outcomes remains inconsistent⁷⁶. However, previous literature also highlights that isolating the effect of discrete strategies is challenging, as they usually are applied in combination, reflecting the complexity of behaviour change in healthcare^{75, 76}. Commonly used strategies include distributing educational materials, organizing educational meetings, external facilitation, and audit and feedback⁷⁵.

Influences from the End-users

End-users refer to the target population of an implementation object, such as patients^{49, 53}, parents³², students⁷⁷, or clients⁵¹. Their motivation, needs, capabilities, opportunities and experiences may influence the implementation^{50, 51} and professionals' adoption of an implementation object⁷⁸. Although there has been a growing interest in involving end-users in research^{79, 80} and in care processes⁸¹, the implementation science field has traditionally focused on determinants at professional and organizational level^{41, 58, 78}. This is illustrated by the fact that end-user-related aspects are explicitly addressed in only 11 out of 17 determinant frameworks⁵⁸. Nevertheless, the field is evolving and updated versions of well-cited determinant frameworks^{50, 51, 53} demonstrate a shift toward greater emphasis on end-users' influence.

In summary, implementation determinants operate at multiple levels, and it is crucial to recognize their interdependence. Rather than acting in isolation, these determinants interact in complex and dynamic ways that collectively shape implementation outcomes⁵⁵.

Implementation Outcomes

A central distinction in implementation science lies between implementation outcomes (e.g., staffs' adoption of innovation) and clinical outcomes. This distinction is essential for determining whether limited effects observed in real-world practice reflect an ineffective intervention per se, or shortcomings in the implementation process⁸². Within the field, implementation outcomes are commonly understood as "*the effects of deliberate and purposive actions to implement new treatments, practices, and services*"⁸². As such, they function as intermediate results that connect implementation activities to changes in service outcomes and, ultimately, to clinical outcomes⁸².

To conceptualize these outcomes, Proctor et al.'s⁸² 2011 taxonomy outlines eight implementation outcomes (Table 1). These outcomes vary in relevance depending on the phase of implementation⁸². A recent review⁸³ shows that appropriateness, feasibility, acceptability, and adoption are most commonly examined during the early phases, whereas outcomes such as cost, fidelity, and penetration tend to be assessed in later phases.

Table 1. Definitions of implementation outcomes according to Proctor et al.⁸².

Implementation outcome	Definition
Acceptability	The perception among implementation stakeholders that a given treatment, service, practice, or innovation is agreeable, palatable, or satisfactory
Appropriateness	The perceived fit, relevance, or compatibility of the innovation or evidence-based practice for a given practice setting, provider, or consumer; and/or perceived fit of the innovation to address a particular issue or problem
Feasibility	The extent to which a new treatment, or an innovation, can be successfully used or carried out within a given agency or setting
Adoption	The intention, initial decision, or action to try or employ an innovation or evidence-based practice
Cost	Cost of an implementation effort
Fidelity	The degree to which an intervention was implemented as described in the original protocol or as it was intended by the program developers
Penetration	The integration of a practice within a service setting and its subsystems
Sustainability	The extent to which a newly implemented treatment is maintained or institutionalized within a service setting's ongoing, stable operations

Understanding implementation outcomes is thus essential when assessing the impact of health promotion interventions on children's and adolescents' health in real-world settings, as intervention effects depend not only on their inherent effectiveness but also on how well they are implemented into relevant health-promoting settings. The following section outlines key concepts in health promotion and disease prevention.

Health Promotion and Disease Prevention

Public health aims to improve population health and reduce health disparities through disease preventive and health promotion efforts^{1, 84}. Health promotion and disease prevention are therefore central concepts within public health.

According to the WHO, health promotion involves the process of enabling people to increase control over and improve their health, while disease prevention focuses on reducing risk factors and preventing the onset of disease⁸⁴. Despite this conceptual distinction, the two approaches are closely interconnected in practice. For example, both approaches ultimately share the goal of improving or maintaining public health and many interventions include both health-promoting and preventive components⁸⁴. As this thesis does not aim to evaluate or problematize the conceptual differences between these terms, the term health promotion is used as an umbrella concept encompassing both health promotion and disease prevention. This choice was made to enhance clarity and readability throughout the cover story.

Health promotion efforts are preferably directed toward everyday environments where people live their lives^{84, 85}. Consequently, child and school healthcare services represent important arenas for promoting health among children and adolescents. These services offer unique opportunities to reach all children, families and adolescents, regardless of socioeconomic background, and thereby have the opportunity to contribute to reducing health inequalities^{6, 7}.

mHealth

What is mHealth?

In recent decades, society has undergone a major digital transformation. Today, digital tools are deeply integrated into everyday life for most individuals. Globally, four out of five people aged 10 years or older own a mobile phone⁸⁶. This development has created new opportunities to deliver care and promote health through mobile technologies^{11, 87}. The abbreviation mHealth is commonly used in both the grey and research literature to refer to interventions that are provided via mobile phones (i.e., “m” for “mobile”).

Definitions of mHealth have evolved alongside technological advancements, and no universal consensus exists. In 2020, Hallberg et al.⁸⁸ identified 30 different definitions of mHealth. One definition is provided by the WHO (2011), which describes mHealth as “*a medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices, personal digital assistants and other wireless devices*”⁸⁹. In 2019, the WHO broadened this definition to “*the use of mobile wireless technologies for health objectives*”, positioning mHealth as a subcategory of the broader eHealth (i.e., “e” for “electronic”)¹¹. eHealth, in turn, falls under the even broader concept of digital health¹¹. In short, digital health is the overarching concept, eHealth is

a subset of digital health, and mHealth is a subset of eHealth (Figure 3). Interestingly, WHO's global strategy on digital health (2020–2025) no longer uses the term mHealth, focusing instead on “digital health” and “eHealth”, and emphasizing that eHealth includes smart and connected devices⁸⁷.

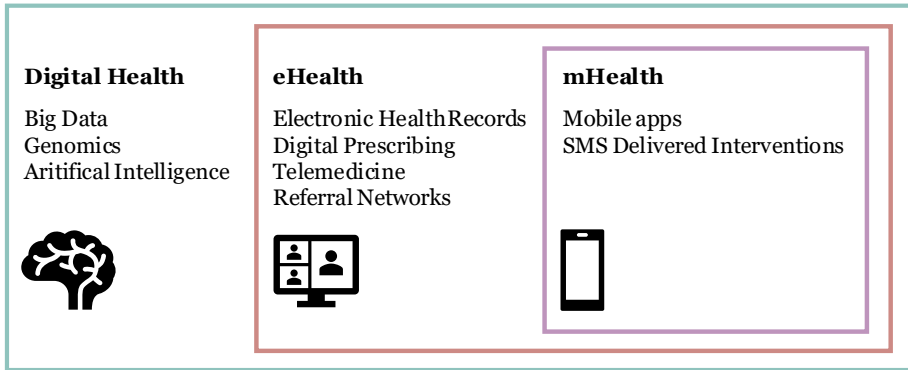


Figure 3. Relationship of digital health, eHealth and mHealth according to WHO (2019)¹¹. Revised from Singal et al.⁹⁰.

mHealth tools may be used for a variety of purposes, such as health promotion initiatives, disease management (e.g., blood sugar monitoring), reminders, and improving communication between patients and healthcare providers^{91, 92}. Common forms of mHealth include mobile applications (often referred to as “apps”) and text- or short- message service (sms)-delivered interventions. Apps used for health-related purposes are also called “health apps” in the literature^{93, 94}. End-users typically access them by downloading them from an app store. The activities undertaken by healthcare professionals vary depending on the intervention design and may for example include, recommending mHealth, registering the end-user to provide app access, or monitoring and following up on end-user data. Moreover, mHealth tools can function as standalone innovations or be embedded within broader interventions⁹¹. This thesis focuses on health-promoting mHealth tools. Throughout the thesis, terms as mobile apps, apps, mobile-based interventions, mHealth and mHealth tools/interventions are used interchangeably.

Because most mHealth interventions generate health-related data (i.e., personal information about an individual's health status⁹⁵) they are governed by both national and international legal and regulatory frameworks, including general data protection regulations^{96, 97} as well as sector-specific legislations, such as the Swedish Patient Data Act⁹⁸ and the EU Medical Device Regulation⁹⁹. Additionally, a key concept discussed in the mHealth literature is interoperability, which refers to the ability of two or more systems or

components to exchange information and to use the information that has been exchanged¹⁰⁰. In other words, this describes how mHealth tools can communicate with existing health information systems and use shared information.

The market for health apps is expanding rapidly. By 2023, more than 350,000 health apps were available in app stores¹⁰¹. Only a minority of these apps have been tested for effectiveness¹⁰¹. The next section provides an overview of the existing evidence on mHealth interventions for health promotion among children and adolescents.

Evidence for mHealth

Reviews and meta-analyses have synthesized the effectiveness of mHealth for health promotion among children and adolescents¹²⁻¹⁶. For example, Singh et al.¹², in a systematic review and meta-analysis, including 25 reviews and 440 randomized controlled trials, reported that eHealth and mHealth have small but positive effects on increasing physical activity, improving dietary habits, and reducing body mass index among children and adolescents under 18 years of age. No significant effects were found for sedentary behaviours or sleep duration. Similarly, a systematic review and meta-analysis by Conley et al.¹³, encompassing 80 studies, found that mHealth interventions have small but statistically significant effects on well-being among children, adolescents, and young adults, and on reducing symptoms of mental ill-health such as anxiety and depression. Although these reviews highlight challenges in comparing findings across studies due to heterogeneity in intervention content, target populations, outcome measures, and follow-up periods¹²⁻¹⁶, they nonetheless overall report small to moderate positive effect sizes^{12, 13, 16}. In addition, because these interventions can be scaled up, even small effects may lead to significant public health benefits when applied to large populations¹², for example through child and school healthcare services. Under such conditions, digital health interventions may be cost-effective compared to traditional, non-digital care¹⁰².

However, despite their potential and demonstrated effectiveness, few mHealth interventions have been implemented in routine care at scale^{17, 18, 103}. This underscores the need for research especially on the implementation of mHealth.

Research on the Implementation of mHealth

Determinants for Implementing mHealth

Several systematic reviews²⁵⁻²⁹ have summarized determinants for mHealth adoption among healthcare professionals. One of the earliest, by Gagnon et al.²⁸ in 2016, identified a wide range of barriers and facilitators, many of which related to the technology itself or the individual adopter, such as perceived usefulness and familiarity with the tool. Later reviews^{25-27, 29} confirm these findings, reporting many determinants related to the innovation (such as perceived usefulness^{25, 26, 29}, ease of use^{25-27, 29}, interoperability challenges^{25-27, 29}, technical issues^{25-27, 29}, concerns regarding data security^{27, 29}), and to the individual healthcare professional (for example, attitudes^{25, 26, 29}, knowledge and skills^{25-27, 29}, trust in the evidence base of the intervention^{25, 26}, and motivation²⁹). Nevertheless, Jacob et al.²⁵ emphasize that social and organizational determinants are even more prevalent, including, for example, opportunities for training to acquire the necessary skills to use the tool, leadership support, sufficient staff resources, collaboration and coordination during the implementation, the availability of policies and guidelines and patient-related factors, such as improved clinical results and perceived adherence. The strong focus on individual and technology-related determinants may be partly explained by the TMFs commonly applied to study mHealth implementation; Technology Acceptance Model¹⁰⁴ and the Unified Theory of Acceptance and Use of Technology¹⁰⁵. These TMFs primarily focus on individual beliefs and perceptions toward technology, while giving less attention to contextual influences¹⁰⁶. Finally, a systematic review by Alkhaldi et al.¹⁰⁷ reports that among the commonly used strategies to support mHealth implementation are educational initiatives, practical support (such as providing app lists and technological systems), and training in how to use mHealth tools in clinical practice.

Organizational Readiness to Implement mHealth

Following the digitalization of society, the concepts of *digital readiness* as well as *eHealth readiness* have been proposed to describe readiness of healthcare organizations to incorporate technological interventions into routine care^{108, 109}. These forms of readiness are described as multi-level constructs influenced by several factors. A fundamental component of both digital and eHealth readiness is the organization's ability to meet the technical requirements necessary to use the intervention^{108, 109}. In addition, aspects such as healthcare professionals

perceived usefulness and ease of use of the technology, the availability of adequate training, and organizational factors including resources and supportive structures are emphasized^{108, 109}. However, both digital and eHealth tools include a wide range of interventions, such as artificial intelligence, healthcare records and clinical information systems¹¹, that primarily target healthcare professionals. In contrast, mHealth interventions are typically designed to ultimately reach the end-users, which might necessitate other forms of readiness, for example readiness to also integrate these interventions into routine healthcare visits and to engage end-users. This highlights a need for further research specifically on organizational readiness to implement mHealth interventions.

Implementation of mHealth in Child and School Healthcare

Digital approaches are increasingly recognized as promising complements to traditional health promotion in schools^{110, 111} and child healthcare services¹¹²⁻¹¹⁵, and existing studies suggest that professionals generally hold positive attitudes toward using mHealth to promote children's and adolescents' health^{77, 115-117}. However, only a limited number of studies have investigated how digital interventions are implemented in these contexts¹¹⁸.

An Australian study⁷⁷, investigating the implementation of a mHealth intervention in schools aimed at preventing depression among children, highlighted that successful implementation requires organizational adjustments, strong staff collaboration, and clear leadership, and that implementation should be approached as an iterative process, adapted to the local context. Similarly, a study within child healthcare in Sweden¹¹⁷ have examined determinants of nurses' behaviour change related to implementing a mHealth tool to support children's healthy lifestyle behaviours, and a study in Norway¹¹⁶ examined nurses' experiences of implementing a web-based resource designed to support children's dietary behaviours. These studies emphasize the importance of leadership support¹¹⁶, staff involvement in intervention development and implementation planning¹¹⁶, as well as training to enhance staff competence and engagement^{116, 117}.

However, most existing studies^{77, 116, 117} have examined mHealth implementation from the staff perspective, such as child health nurses, teachers, and school counsellors, while perspectives of managers or decision-makers are lacking. Furthermore, previous studies on mHealth implementation in schools and child healthcare^{77, 116, 117} suggest that end-users, i.e., parents and students, influence the implementation process through their engagement. Yet, how contextual factors influence end-user adoption as well as the end-users' perspectives on the implementation of mHealth remains insufficiently

understood^{119, 120}. This gap may be particularly relevant in mHealth implementation, as end-users are expected to actively engage with the intervention, for example by downloading the app, becoming familiar with it, and ultimately using it over an extended period of time.

Rationale

Over the past decades, digital development has opened new opportunities for health promotion efforts. mHealth interventions hold potential to complement traditional health promotion approaches by offering support anytime and anywhere, while enabling reach to large populations¹². Indeed, evidence suggests that mHealth may promote healthy lifestyle behaviours and mental health among children and adolescents¹²⁻¹⁶. However, most mHealth implementation research has focused on adult populations with chronic conditions in hospital and primary care settings²⁵⁻²⁹. In contrast, few studies have examined implementation within child and school healthcare services; settings that are central to public health promotion.

Furthermore, in the field of mHealth implementation, the vast majority of research has used TMFs that largely focus on the technology or the individual adopter¹⁰⁶. Earlier research²⁵ has emphasized that contextual factors play a substantial role in the adoption of mHealth, suggesting that further research is needed to illuminate this perspective.

Although there is a growing recognition of end-users' importance in implementation processes, traditional implementation research has predominantly focused on factors within the healthcare organization^{41, 58, 78}. To enhance our understanding of how new interventions may be integrated into routine practice, more knowledge is needed on implementation from the perspective of end-users. This knowledge gap might be particularly critical for mHealth tools, as these interventions are highly end-user centred, requiring end-users to take an active and engaged role in downloading and using the intervention.

Organizational readiness is recognized as a key factor for implementation success⁶¹. Indeed, assessing organizational readiness may enhance our understanding of factors influencing implementation outcomes, and support organizations in preparing for implementation. However, to date, empirical research remains scarce on whether organizational readiness is indeed associated with higher implementation outcomes^{62, 65, 67}. Furthermore, previous research on organizational readiness for digital interventions has primarily focused on broader digital health or eHealth domains, such as readiness for implementing electronic health records and clinical information systems. There is a paucity of research regarding the specific forms of readiness required to implement mHealth interventions.

Aims

The overall aim of this thesis was to generate knowledge about the implementation of mHealth interventions that support health promotion practices during routine health visits in Swedish child and school healthcare.

Specific aims:

Study I: To explore perceptions among nurses, managers, and policymakers regarding organizational readiness to implement mHealth for the promotion of healthy lifestyle behaviors in child and school healthcare.

Study II: To a) assess various dimensions of organizational readiness prior to implementation of an evidence-based digital health promotion program in Swedish child healthcare (MINISTOP), and b) investigate the associations between the assessed organizational readiness dimensions and the adoption of MINISTOP.

Study III: To explore high school students' perceptions of determinants for adopting a mental health app, following routinized health visits in Swedish school healthcare.

Study IV: To investigate similarities and differences in implementation determinants across schools with different levels of adoption, when a mobile-based mental health promotion tool was introduced during routine health visits in Swedish high schools.

Theory and Framework Used in this Thesis

This chapter presents the theory and the framework relevant to the studies, explaining why they were selected and describing how they were applied. Overall, TMFs differ in their foundational assumptions and characteristics, which influence the perspectives they offer to describe, understand, or explain implementation⁴¹. Previous research on mHealth implementation has often applied TMFs that primarily have a technology- or individual-oriented perspective¹⁰⁶. However, factors influencing implementation may be influenced by factors beyond these levels. This thesis therefore employs a theory and a framework that address contextual and collective perspectives, aiming to provide a broader picture of implementation.

Studies I and II were grounded in the concept of organizational readiness and used the Theory of Organizational Readiness for Change (ORC)⁶¹ to understand readiness to implement health-promoting mHealth interventions and its association with implementation outcomes. This theory was selected because of its strong emphasis on organizational and collective perspectives in relation to an upcoming change. ORC⁶¹ was applied in several ways during the studies. First, it shaped the aims (and thus background) of both studies. Second, it informed data collection; in Study I ORC⁶¹ broadly inspired the interview guide, and in Study II it partly underpinned the questionnaire used to assess organizational readiness¹²¹. Third, the ORC⁶¹ was applied in the interpretation of findings; the results were mirrored against ORC⁶¹ to assess alignment (Study I), identify aspects not captured by the theory (Study I), and discuss its empirical validity and conceptual challenges (Study II). In addition, the ORC⁶¹ was used in the cover story to discuss and explain the main findings of the thesis.

Study IV applied the Consolidated Framework for Implementation Research (CFIR)⁴⁹, selected for its broad and comprehensive perspective on contextual factors, offering a “meta-view” of the implementation. Furthermore, the framework enables a systematic identification of the determinants most critical to implementation success. The CFIR⁴⁹ was used as a tool throughout study IV to investigate similarities and differences in implementation determinants across schools with different levels of mHealth adoption. It gave structure to the development of the interview guides, guided deductive coding during analysis, and was used to compare determinants across schools with varying levels of mHealth adoption. In addition, CFIR⁴⁹ was applied in the cover

story to organize and synthesize the main findings from the four included studies and to support the discussion and interpretation of the thesis's results.

Together, ORC⁶¹ and CFIR⁴⁹ provided a complementary and coherent analytical approach across the different phases of implementation. ORC⁶¹, with its focus on organizational and collective aspects of anticipated change, was applied in studies I and II, which were conducted prior to or in early stages of the implementation (*preparation phase*). In contrast, CFIR⁴⁹, which captures a broader range of evolving contextual determinants that shape implementation outcomes, was applied in study IV, conducted during the active *implementation phase*.

The Theory of Organizational Readiness for Change

The Theory of Organizational Readiness for Change (ORC) was developed by Weiner in 2009⁶¹. As previously described, ORC⁶¹ is defined as a shared psychological and behavioural state among organizational members, and with other words, their collective willingness and ability to implement a specific change. According to the theory, in organizations with high readiness, organizational members will take more initiatives and collaborate more effectively, thereby enhancing the implementation effectiveness (Figure 4).

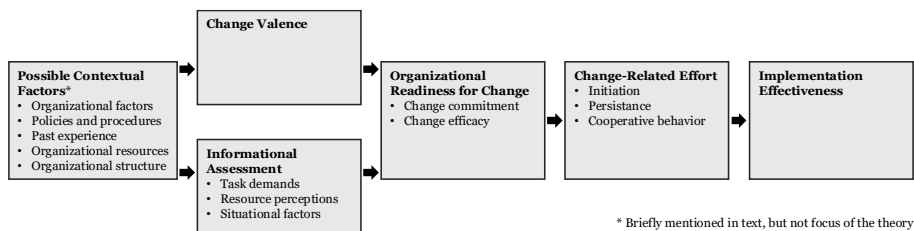


Figure 4. The Theory of Organizational Readiness for Change. Reproduced from Weiner under CC BY license⁶¹.

The theory⁶¹ posits that ORC is a function of organizational members change commitment and change efficacy. *Change commitment* refers to members shared determination to pursue the steps that are needed to implement the change in question. Change commitment in turn, is influenced by change valence, that is, the extent to which members value the proposed change. The more the change is perceived as valuable, the stronger their determination to carry out the necessary steps. This perceived value may stem from various reasons, such as believing that the change will solve an existing problem or

improve current practices, or because it is supported by leaders and colleagues. *Change efficacy* refers to organizational members shared belief in their collective capability to organize and actively carry out the actions that are needed to implement the change. This belief emerges from a shared informational assessment conducted by members, which evaluates three determinants: 1) task demands (i.e., what the change involves and requires), 2) perceptions of available resources (i.e., whether sufficient resources exist to implement the change), and situational factors (i.e., whether implementation is feasible given the local conditions). Change valence and informational assessment are, in turn, influenced by contextual factors such as organizational culture, policies and procedures, and prior experiences with change. In Weiner's theory⁶¹, these contextual factors represent a more general capacity for change across the organization, whereas change valence and informational assessment are described to be situation-specific and shaped by the particular change being implemented.

By emphasizing collective behavioural change, the theory highlights the organizational level of analysis. Furthermore, it underscores that the theory is particularly relevant when implementing changes that require coordinated, collective efforts, rather than changes that primarily depend on individual behavioural change.

The Consolidated Framework for Implementation Research

The Consolidated Framework for Implementation Research (CFIR) was originally developed by Damschroder et al.⁴⁹ in 2009, by consolidating constructs from 19 TMFs, considered to influence implementation outcomes. CFIR⁴⁹ was organized into 38 constructs, distributed on five domains, all proposed to interact and collectively influence implementation outcomes. The first domain, *intervention characteristics*, relates to features of the intervention, and how these are perceived by the individuals who use the intervention. The second domain, *the outer setting*, involves the economic, political, and social context in which an organization is nested, including, for example, patient needs and resources and organization's relationships with other external entities. Changes in outer setting are proposed to be mediated through the third domain, *the inner setting*. The inner setting involves structural, political and cultural characteristics of the implementing organization and includes for example constructs related to culture, relational networks and leadership engagement. The fourth domain focuses on the

individuals involved in the implementation, including their knowledge, beliefs, and confidence in using the intervention. The fifth, and last *process domain*, encompasses both formal and informal activities related to the implementation process, such as planning, engaging stakeholders and evaluating the implementation.

Consequently, CFIR offers a comprehensive standardized categorization of constructs known to influence implementation outcome. However, as a determinant framework, it is primarily descriptive, and it do not specify how the determinants interact or the causal mechanisms through which they influence implementation outcomes^{49, 55}.

CFIR has been widely applied across diverse settings, including healthcare, education, and public health⁵⁰, and has been used to examine various digital health implementations, including eHealth¹²² and mHealth interventions^{123, 124}. Furthermore, researchers are increasingly employing CFIR as an evaluative approach to identify which constructs most strongly influence implementation outcomes^{50, 125, 126}.

Based on user feedback, the framework was updated in 2022, including revisions to existing domains and constructs, as well as the removal and addition of constructs⁵⁰. However, the updated version of CFIR⁵⁰ was not applied in this thesis. Study IV employed CFIR as an evaluative approach, as proposed by Damschroder and Lowery¹²⁶. To do this, we relied on the tools provided on the CFIR webpage¹²⁷, which at the time of the study, had not yet been adapted to the updated version. Furthermore, we sought to compare our findings with previous studies that had employed the CFIR evaluation approach in school settings^{128, 129}.

mHealth Interventions Used in This thesis

In the thesis, mHealth implementation was investigated using three examples of health-promoting interventions. These interventions were deliberately chosen not only because they share the common goal of promoting health among younger populations, but also because of their differences. Specifically, they vary in focus, addressing both lifestyle and mental health, and in the behavioral requirements placed on nurses depending on the design and intended use of the tool. This variation increases heterogeneity and enriches the understanding of mHealth implementation.

The LIFE4YOUth

The LIFE4YOUth³⁰ was developed as part of the MoBILE research programme³⁰ and targets high school students to support healthy diet, physical activity, smoking cessation, and low-risk alcohol consumption. The intervention lasted for 16 weeks and consisted of three components: weekly screening, a digital dashboard, and SMS services. The screening involved sending students an automated weekly SMS with a link to a web-based questionnaire where they reported their behaviours in the four targeted areas (Figure 5). Based on their responses, students received feedback through the dashboard, which provided information, exercises, and strategies for behaviour change. From the dashboard, students could activate additional SMS services and personalized reminders to support their change efforts. The intervention was available in Swedish. Students gained access to the intervention by sending a text message to request trial information and confirm their consent to participate in an effectiveness trial³⁰. The LIFE4YOUth has shown modest positive short-term effects (at 2 months) on physical activity as well as fruit and vegetable consumption³⁰.

LIFE4YOUth³⁰ was used in Study I, where school nurses who had previously enrolled students in the LIFE4YOUth trial³⁰ during routine health visits were recruited. A detailed description of the LIFE4YOUth trial is provided elsewhere³⁰.



Figure 5. Screenshot of LIFE4YOUth dashboard.

The MINISTOP

The Mobile Based Intervention Intended to Stop Obesity in Preschoolers (MINISTOP)^{31, 32} aims to improve healthy lifestyle behaviours (i.e. diet, physical activity, sedentary time) among families with 2–3-year-old children (Figure 6). MINISTOP consists of two parts: the MINISTOP app (for parents), and a web-based interface (for child healthcare nurses). The interface is used by nurses to register parents, enabling them to download and access the app. The app delivers a six-month intervention structured around 13 themes (for example, everyday meals and snacking) introduced every second week. The app also includes a resource library for additional guidance and advice, as well as a self-monitoring and feedback feature that allows parents to register their child’s dietary intake, physical activity, and screen time. The app is available in Swedish, Somali, and Arabic.

The program has been evaluated in two randomized controlled trials as well as several qualitative studies^{31, 32, 114, 115, 131}. MINISTOP has shown positive effects on children’s consumption of sweet and salty snacks, sugary drinks, and screen time after six months³¹. In addition, parents have reported increased self-efficacy in promoting healthy eating habits and physical activity in their children³¹. Also, parents and nurses have reported high usage and satisfaction with the app^{31, 115}.

MINISTOP^{31, 32} was used in Studies I and II. In Study I, interviews were conducted with child healthcare nurses who had previously enrolled families in

the MINISTOP trial³¹. A detailed description of the MINISTOP trial is available in previously published work³¹.

Study II examined the subsequent implementation of MINISTOP³² in child healthcare. Following the MINISTOP trial³¹, interest in implementing the program into routine practice increased within child healthcare. National policymakers at a Swedish private healthcare organization therefore decided to implement MINISTOP during routine health visits for 2.5/3-year-old children across all 77 child healthcare centers operated by the organization at the time (2021/2022). All centers initiated implementation with the same bundle of implementation strategies: (1) an educational meeting, (2) written educational materials, and (3) a formal implementation blueprint (Table 2). Implementation was conducted in phases, with centers grouped into “waves” that received the implementation strategies at different time points. Study II includes centers that initiated implementation across six waves during 2023. Further details regarding the implementation of MINISTOP are provided elsewhere³².

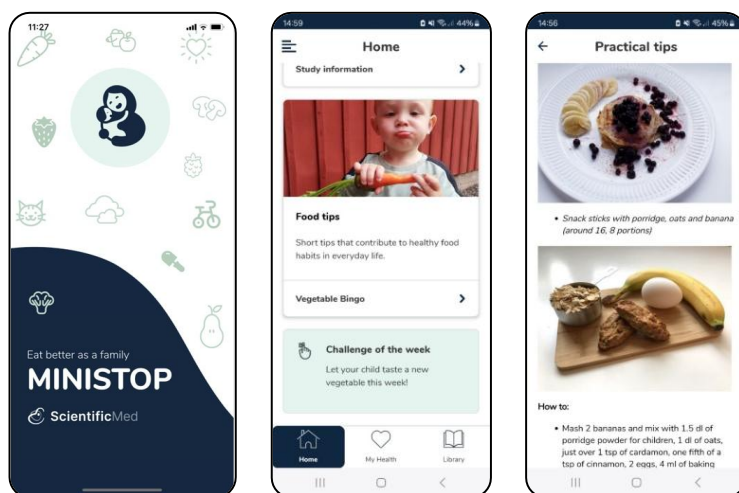


Figure 6. Screenshots of the MINISTOP app³².

On the Inside

On the Inside³³ (Swedish: Det Syns Inte, abbreviated as DSI) is a tool aiming to promote mental health among high school students. The DSI was developed as a spin-off from a larger school-based mental health program, which included classroom-delivered resources and materials (not part of this thesis)¹³². DSI³³ is

based on a youth-adapted version of the Healthy Mind Platter¹³³, which describes seven factors that together support mental health (chill time, exercise, sleep, downtime, relationships, activities, focus time). In this thesis, the tool consists of two components: the DSI-app for students, and paper-based materials for school nurses during health visits (Figure 7). The paper-based materials visually illustrate the platter and support nurses in discussing mental health with students. The app³³ provides information on why these seven factors are important, and advice on how to support them. The app also includes basic guidance on thought diffusion technique. Both components include a screening tool covering the seven factors. The app is available in Swedish. Students access the app by downloading it from an app-store.

The DSI tool³³ was used in Study III and IV, both conducted within the Mobile Implementation Project (MIP), which aimed to implement DSI³³ during health visits in high schools. This project was initiated in 2022, when the research team contacted school principals and school nurses to assess their interest in implementing the DSI. In the seven schools that agreed to participate in implementation, all school nurses received the same bundle of implementation strategies, which consisted of an educational meeting and written educational materials (Table 2).

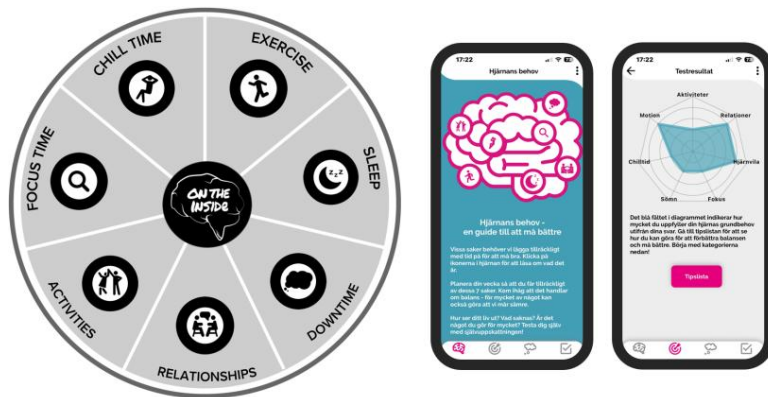


Figure 7. Picture of the DSI tool, consisting of the paper-based material for nurses (left) and the app for students (right)³³.

Table 2. Description of implementation strategies in the implementation of the MINISTOP³² and the DSI³³.

mHealth intervention	Implementation strategy	Description of implementation strategies
Implementation of the MINISTOP	Educational meeting	One-hour digital session introducing MINISTOP, its research basis, and integration into routine health visits. Led by the research team, platform developer, and child healthcare project leader.
	Formal implementation blueprint	Document outlining implementation goals and timeline, developed with the research team and senior child healthcare representatives. Communicated during the educational meeting.
	Educational materials	Manual for registering families in the MINISTOP interface, printed resources for health visits, and a QR code for easy app download.
Implementation of the DSI	Educational meeting	On-site (one digital exception) sessions led by the PhD student (MF), introducing the DSI, its rationale, implementation goals, and integration into routine health visits.
	Educational materials	Developed by the research team, including paper-based DSI materials for health visits, guidance for integration, a scientific report on adolescent mental health, and a QR code for direct app access.

Methods

This chapter describes the methods employed and the context in which the studies were conducted. It begins with a description of the research setting, including an overview of Swedish child and school healthcare. Ontological and epistemological foundations that underpin the research are then described. Following this, the specific methods applied in each study are detailed. The chapter concludes with ethical considerations.

Research Setting

Overview of Swedish Child and School Healthcare

This thesis was conducted within Swedish child and school healthcare. Sweden is a highly digitalized welfare state, where the healthcare and school systems are publicly funded and free of charge^{134, 135}. Child healthcare is organized under 21 regions, while school healthcare falls under 290 municipalities¹³⁴. In both contexts, nurses play a central role in delivering health-promoting and preventive services¹³⁶. A key component of their work involves health visits with children, adolescents, and for younger ages, together with parents^{6, 7, 135}. These visits aim to enable early identification of needs and promote health, with the visit and support tailored to each child's or adolescent's developmental stage^{6, 7}. Traditionally, this is achieved through screenings, conversations, and counselling, with nurses adapting both the visit and the support provided to the child's or adolescent's age and individual needs^{6, 8, 113, 137}, while building trusting relationships with adolescents and families constitutes a central pillar of the work¹³⁷⁻¹³⁹. In total, approximately 15-16 visits are scheduled within child healthcare⁸, at least three during primary school and one in high school¹³⁵.

This thesis investigates the implementation of mHealth during health visits with 2.5/3-year-olds in child healthcare and first-year high school students (16–17-year-olds), as the mHealth tools were designed for these specific age groups. The organizational structure of child and school healthcare is described below and illustrated in figure 8.

The Child Healthcare System

Child healthcare services are responsible for promoting children's health from birth until the children start primary school^{7, 136}. These services are governed by regions, are part of primary care and are regulated by the Health and Medical

Services act¹⁴⁰. Many child healthcare centers are located alongside primary care centers⁷. Centers can be publicly or privately operated⁷. At smaller units, child healthcare nurses often share management with primary care staff, while larger centers may have dedicated leadership. Child healthcare centers are primarily led by nurses specialised in district nursing or child and adolescent health^{7, 136}. In addition, physicians, child psychologists, and occasionally other professionals such as dietitians or social workers are affiliated with the center⁷.

Child healthcare is guided by national recommendations, outlined in the “Guidance for Child Health Services” (Swe; “Vägledning för barnhälsovården”)⁷. Complementing this is a methodological and knowledge-based resource, known as the “National Handbook for Child Health Services” (Swe; “Rikshandboken för barnhälsovård”)⁸. Commissioned by the Swedish Association of Local Authorities and Regions, the handbook is based on the national recommendations and is continuously updated and reviewed by the Swedish Child Health Services Council (Swe; BHV-rådet), an editorial board consisting of specialists with diverse expertise in child health care⁸.

The School Healthcare System

Schools and school healthcare services are responsible for promoting health among children and adolescents from the start of primary school throughout the school years¹³⁶. According to the Swedish Education Act¹³⁵, all schools, whether municipal or independently governed, are required to provide access to school healthcare services. The purpose is to support students’ development towards educational goals and promote their overall health.

School healthcare must include access to a school physician, school nurse, psychologist, counsellor, and special education teacher. Together with the principal, these professions form what is referred to as the “*school healthcare team*” (Swe; ”elevhälsoteam”). The school nurses and school physicians constitute the medical part of school healthcare, which is regulated by the Health and Medical Services Act¹⁴⁰. This part is responsible for conducting health visits and contributing with medical expertise to the school’s health-promoting efforts⁶. It is recommended that school nurses have education in public health or child and adolescent health¹⁴¹. School nurses, special education teachers, and counsellors are typically based at schools, while school physicians and psychologists, are usually connected to the schools and brought in when their expertise is needed.

The overall responsibility for providing school healthcare lies with the school’s principal authority, either the municipality or the board of an independent school. However, the organization of services may vary depending on local conditions⁶. School healthcare staff may be employed directly at the

school or centrally within the municipal/independent organizer administration. For school nurses, central employment is most common¹⁴². Since the medical part of school healthcare services falls under the Health and Medical Services Act, schools must ensure that care is safe and of high quality⁶. As principals commonly lack medical expertise, managerial responsibilities for the medical work of school nurses are frequently delegated to designated nurses within the municipality or independent organizers⁶. This role is referred to as a “Medical Responsible Nurse” (Swe; Medicinskt Ansvarig Sköterska (MAS)). National guidance for school healthcare is provided through “the Guidance for Student Health Services” (Swe; “Vägledning för elevhälsan”) that has been developed by the National Board of Health and Welfare and the Swedish National Agency for Education⁶.

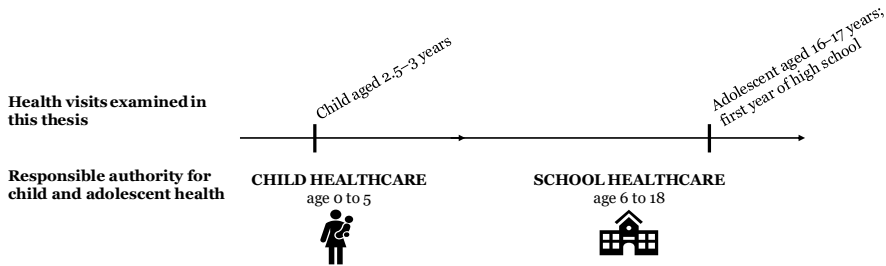


Figure 8. Overview of the division of responsibilities for children’s and adolescents’ health between child and school healthcare, including the routine health visits during which the mHealth tools were implemented in this thesis.

Ontological and Epistemological Perspectives

Research is grounded in various philosophical paradigms, which encompass fundamental assumptions about reality, how reality can be understood and appropriate approaches to address research questions¹⁴³. Historically, medical research has primarily been positioned within the postpositivist and constructivist paradigms¹⁴⁴.

The postpositivist paradigm, which has long dominated medical science¹⁴³, is based on the assumption that an objective reality exists and that it can be observed and measured through scientific methods. Consequently, this paradigm is primarily associated with quantitative approaches, where the aim is to produce objective knowledge through reliable and valid measurements¹⁴³,

complemented by statistical analyses that enable the generalization of findings^{144, 145}. In contrast, the constructivist paradigm assumes the existence of multiple subjective realities, shaped by individual experiences, social interactions, and contexts^{143, 144}. Knowledge is viewed to be co-created by and between individuals, meaning that data must be interpreted in relation to its context, the individuals involved, and the researcher¹⁴⁵. This paradigm commonly employs qualitative approaches and is particularly useful when studying phenomena that are novel or not yet well understood, where an exploratory approach is warranted^{146, 147}.

However, due to the practice-oriented nature of the thesis' research questions, overall focusing on generating knowledge about mHealth implementations in real-world settings, this thesis is positioned within the pragmatic paradigm. Pragmatism has an emphasis on research questions embedded in the practical understanding of concrete, real-world issues¹⁴⁷. Pragmatism assumes that something is "true" or meaningful if it has utility in practice¹⁴⁷. Knowledge is considered changeable and context-dependent, serving as a tool to generate insights that inform actions and contribute to solving the problem in practice¹⁴⁷. Within this paradigm, emphasis is placed on using the methodology that is most appropriate for answering the research question¹⁴⁷. Researchers may draw on qualitative assumptions when for example exploring new research topics, and on quantitative assumptions when the aim is to measure variables and generalize findings to larger populations¹⁴⁵.

In this thesis, qualitative approaches were used to explore perceptions of organizational readiness to implement mHealth (Study I), as well as to investigate determinants for implementation (Studies III and IV). A quantitative approach was applied in Study II to assess organizational readiness and examine its association with the adoption of mHealth. The combination of these methodological approaches provided a more comprehensive understanding of mHealth implementation.

Researcher Characteristics and Reflexivity

In qualitative research, the researcher functions as a tool¹⁴⁷, meaning that the design of the study, the data collection, and the analysis and interpretation of data are shaped by the researcher's perspectives¹⁴⁵. As a qualitative researcher, it is therefore essential to become aware of and continuously reflect on one's own preunderstanding, i.e., experiences, values, and background, which may shape the findings of the study¹⁴⁵. Moreover, for other researchers and readers, it is important to understand from whose perspective the research has

been conducted. My professional background includes several years of experience as a physiotherapist in healthcare, as well as work as a project manager for the implementation of a quality register in neurology clinics. As a physiotherapist, health promoting work is a natural part of the role. However, I do not have experience working within child or school healthcare. Being familiar with the context can be advantageous, as it may allow for a more nuanced and richer understanding¹⁴⁸. At the same time, lacking prior experience may offer opportunities, such as enabling a helicopter perspective, and remaining open to new perspectives that someone with extensive experience might overlook, as aspects may be perceived as “normal” and therefore go unquestioned. To address my limited experience within child and school healthcare, I engaged in discussions with research team members who had contextual knowledge and gradually, I developed a familiarity with the contexts.

My academic background is in physiotherapy and biotechnology, both fields largely shaped by the postpositivist paradigm. Furthermore, implementation science emerged from the evidence-based practice movement in the 1990s^{22, 34} and has therefore been strongly influenced by the medical field and the postpositivist perspective^{149, 150}. Despite this, I acknowledge the importance of using alternative perspectives to understand implementation. I believe that implementation is, by nature, a collective process to incorporate a new way of working into routine practice within a specific context. Reality is therefore continuously shaped by thoughts, social interactions, and experiences of stakeholders in a particular setting. As a result, there is no single reality. Instead, multiple “truths” may coexist depending on what is being implemented, where, and when it occurs.

Study Designs

This section outlines the approaches taken to generate knowledge on the implementation of health-promoting mHealth interventions in child and school healthcare. An overview of the studies is presented in Table 3.

Table 3. Overview of the studies included in the thesis and their design.

	Study I	Study II	Study III	Study IV
Setting	Child and school healthcare	Child healthcare	School healthcare	School healthcare
mHealth intervention	MINISTOP ³¹ and LIFE4YOUTH ³⁰	MINISTOP ³²	DSI ³³	DSI ³³
Study design	Qualitative interview study	Quantitative observational prospective study	Qualitative interview study	Qualitative interview study with cross-case comparisons
Participants	Child and school healthcare nurses, managers and policymakers	Child healthcare nurses	High school students	School nurses and principals
Data collection	Semi-structured interviews (n = 28)	Questionnaires and adoption data through the MINISTOP interface (n = 83)	Semi-structured interviews (n = 18)	Semi-structured interviews (n = 15, 5 schools) and adoption data through students' charts
Data analysis	Inductive content analysis	Rasch analyses, descriptive statistics, correlation analyses, and negative binomial regressions	Inductive content analysis	Inductive content analysis. Deductive content analysis using the CFIR ⁴⁹ . Generation of case- memos, cross-case analysis.

Study I

Study I employed a qualitative design using individual interviews with nurses, managers, and decision-makers to explore their perceptions of organizational readiness for implementing mHealth in child and school healthcare. As organizational readiness for mHealth was still largely unexplored at the time, a qualitative approach was considered appropriate¹⁴⁷. Semi-structured interviews enabled richer insights into informants' perceptions, allowed for emerging topics to be followed up during the interviews¹⁴⁸, and provided informants with the opportunity to speak freely about their experiences and perspectives without influence from others. This method also made it possible to include informants from heterogeneous contexts and was considered a practical method, allowing participants to choose a time that suited their needs. Given the limited existing knowledge on organizational readiness for mHealth implementation, an inductive content analysis was applied¹⁵¹. In this approach, codes are derived directly from the data to support the identification of patterns beyond predefined theoretical frameworks¹⁵¹. Content analysis keeps the researcher close to the data, rather than relying on pre-existing theoretical or philosophical assumptions, making it particularly well suited for exploring practice-oriented and clinically relevant questions¹⁴⁶.

Study II

Study II was designed as a prospective observational study to assess organizational readiness prior to the implementation of mHealth (MINISTOP³²) in child healthcare, and to examine how organizational readiness was associated with nurses' adoption of the intervention. A quantitative approach enabled assessment of readiness dimensions across a larger sample of child healthcare nurses and allowed for statistical analyses of associations between these dimensions and adoption of MINISTOP³². The observational design was well-suited to the real-world implementation context, as the goal was not to manipulate the implementation, but to observe the naturally occurring implementation process¹⁴⁴. Furthermore, the observational nature of the study enhanced the generalizability of the findings¹⁴⁴. Organizational readiness was assessed by each child healthcare nurse at baseline using a questionnaire¹²¹. Adoption was defined as the "intention, initial decisions, or action to try or employ an innovation or evidence-based practice"⁸² and was operationalized as each nurse's total number of MINISTOP registrations during baseline and the first 19 weeks of implementation. One registration indicated that a family had accepted the MINISTOP app, and the nurse entered their information into the web interface to enable them to download and access the app.

Study III

Study III employed a qualitative approach using semi-structured interviews with high school students, to explore their perceptions of the determinants influencing the adoption of a mental health app following routinized health visits. End-user adoption of mHealth from a broader implementation perspective, i.e., extending beyond technology and individual-level considerations, was at the time of the study an unexplored area, which motivated the choice of a qualitative design¹⁴⁷. Adoption was defined as “the intention, initial decision, or action to try or employ an innovation”⁸², i.e., students’ intention to download the app and the initial use of the app. Data were collected by semi-structured interviews, enhancing opportunities for gathering richer data on students’ perceptions regarding determinants of adoption, allowing for deeper exploration of emerging topics during the interviews¹⁴⁸. Individual interviews were considered the most practical option and provided a chance for participants to speak freely¹⁴⁷. An inductive content analysis was applied, as there was limited existing knowledge specifically addressing end-users’ perspectives on adoption¹⁵¹, and the study aimed to generate findings closely aligned with practical relevance¹⁴⁶.

Study IV

Study IV employed a qualitative design with cross-case comparisons, guided by the CFIR framework⁴⁹, to investigate similarities and differences in implementation determinants across schools with varying levels of adoption of the DSI. This approach enabled a richer understanding of factors influencing implementation¹⁴⁷, and facilitated systematic comparisons between schools.

Data were collected six months after the start of implementation through individual semi-structured interviews with school nurses and principals from five Swedish high schools. This method allowed participants to articulate their views openly and provided opportunities to explore emerging issues in greater depth^{147, 148}. Adoption was defined as “the intention, initial decisions, or action to try or employ an innovation or evidence-based practice”⁸² and was assessed at the school level based on nurses’ aggregated use of the DSI over the same six-month period. A deductive analytical approach was applied using CFIR⁴⁹ as the framework. For each school, the researchers assessed all CFIR constructs, determining whether they functioned as barriers or facilitators and the strength

of their influence¹²⁶. Construct ratings were then compared across cases to identify constructs that distinguished schools with different levels of adoption.

Recruitment and Participants

Study I

Study I was an interview study to explore perceptions of organizational readiness to implement mHealth. A purposeful sampling method, specifically heterogeneity sampling, was used to select information-rich informants who could offer diverse perspectives and thereby contribute to a richer understanding of the phenomenon¹⁴⁷. Firstly, three levels of informants were included: nurses, managers and policymakers. Secondly, informants were recruited from organizations of varying sizes, geographical locations, socioeconomic areas, and educational profiles. Thirdly, informants were recruited from the two different mHealth trials (MINISTOP³¹ and LIFE4YOUth³⁰), ensuring that they had experience using mHealth and also broadened the perspectives on readiness for various types of mHealth tools. All informants were contacted via email, which outlined the purpose of the study and included an invitation to participate in an interview.

Nurses were recruited through contacts with researchers involved in the MINISTOP³¹ and LIFE4YOUth³⁰ trials and were eligible if they had experience using the mHealth tools during health visits. Regarding child healthcare, all child healthcare nurses who participated in the MINISTOP trial³¹ were invited to take part in interviews. The first six nurses who responded to the email were selected for interviews since they represented heterogeneous contexts. Regarding school nurses, seven were invited and four agreed to participate. All nurses that participated in the study were female, aged 34 to 65 years (mean 45), with 6 to 24 years of experience (mean 10) working in child or school healthcare.

Managers were included if they held a management position at a child or school healthcare center participating in either the MINISTOP³¹ or LIFE4YOUth trials³⁰. A total of 24 managers were contacted, of whom 10 agreed to participate (five male and five female). Ages of participating managers ranged from 34 to 60 years (mean 53 years). On average, they had 5 years of experience as managers (range 2 to 9 years). All managers within child healthcare held operational roles at either primary care centers or child healthcare centers. In school healthcare, managerial roles were positioned at various levels, including coordinating school nurses, medical responsible nurses, and managers at central school healthcare organizations within the municipality.

Policymakers were included if they had responsibility for or were involved in the organization's digital strategy. Potential informants were identified through searches on organizational websites, focusing on individuals with strategic responsibilities in digital development. In addition, snowball sampling¹⁴⁴ was used, where informants were asked to refer other potential participants. In total, 19 individuals were contacted, and eight agreed to participate. Of these, all were male, with a mean age of 51 years (range 42 to 62 years), and an average of 11 years of experience as policymakers (range 4 to 19 years). The four policymakers representing the school sector held strategic roles related to digital development within the municipality. The four representing child healthcare held similar responsibilities within regions or private healthcare providers.

In total, 28 informants participated in the study: 10 nurses, 10 managers, and 8 policymakers.

Study II

Study II was an observational prospective study conducted during the first year of the implementation of MINISTOP³² in child healthcare. To ensure comprehensive coverage, all nurses (n = 135) employed at child healthcare centers (n = 48) that initiated implementation during 2023 were invited. Verbal information about the study was provided during MINISTOP³² educational meetings, while written information including invitation to participate and direct link to the questionnaire was distributed via email. To be included in the study, nurses had to be employed at one of the participating child healthcare centers and be able to provide all required data for the study. Nurses who had been employed for less than three months were excluded, as they were not considered to have sufficient experience to assess organizational readiness. In addition, nurses who did not remain at their workplace throughout the 19-week study period were excluded.

Among the invited, 89 nurses from 40 centers agreed to take part and completed the questionnaire, resulting in a response rate of 66%. Five participants did not fulfil the inclusion criteria since their respective centers were unable to report all necessary data, and one was excluded due to taking parental leave during the study period. Subsequently, 83 nurses from 37 different child healthcare centers participated in the study (Table 4).

Table 4. Characteristics of participants and child healthcare centers in Study II.

Participant Characteristics (n= 83)	
Variable	Value
Years of age	
Mean (SD ^a)	45 (9)
Range (min-max)	31-63
Gender, n (%)	
Female	82 (99%)
Male	0 (0%)
Prefer not to disclose	1 (1%)
Years of experience in child healthcare	
Mean (SD ^a)	8 (7)
Range (min-max)	0-40
Years of experience at current workplace	
Mean (SD ^a)	6 (4)
Range (min-max)	0-20
Characteristics of Child Healthcare Centers (n=37)	
Variable	Value
Clinic size, number of centers (%)	
1 employed nurse	3 (8%)
2-4 employed nurses	29 (78%)
≥5 employed nurses	5 (14%)
*SD = Standard Deviation	

Study III

Study III was an interview study to explore high school students' perceptions of determinants for adopting a mental health app following routinized health visits. A purposeful sampling strategy¹⁴⁷ was initially planned to capture informants with diverse perspectives on the topic, with heterogeneity sought in terms of educational profiles and gender. However, due to the limited number of students recruited after six months, the sampling strategy was revised to a convenience sampling method. School nurses informed and invited students during health visits. If a student expressed interest, the research team was contacted, and the student received written information about the study via email. Several strategies were employed to support recruitment. Verbal

information about the study were given in class by MF, and additional information was distributed via flyers as well as schools' intranet. As compensation for participation, students received a gift card valued at 100 Swedish kronor. Since recruitment was mediated through school nurses, the exact number of students approached and those who declined participation remains unknown. Students in their first year of high school who had been recommended the DSI app during their routine health visit were eligible to participate.

A total of 18 students were interviewed (all female), ranging in age from 15 to 18 years (mean age 16). Of these, 8 were enrolled in vocational degree courses, while 10 pursued theoretical degree courses.

Study IV

Study IV used a qualitative approach with cross-case comparisons, guided by the CFIR⁴⁹, to investigate similarities and differences in implementation determinants, across schools with different DSI adoption levels. As part of the Mobile Implementation Project (MIP), schools were selected using a purposeful sampling strategy to ensure variation in contextual factors, with heterogeneity considered regarding school size and educational profiles. Contact details for potential schools were provided by researchers involved in the LIFE4YOUth-trial³⁰. Initially, seven schools were approached, of which five agreed to participate. Two further schools were recruited via one of the participating schools. In total, seven schools were included, although two later withdrew their participation. Consequently, five schools participated in the study (Table 5). Eligible participants were school nurses and their principal at the participating schools. Invitations and information were distributed via email, supplemented by verbal information during educational meetings. Participants employed at a school for less than three months were excluded, as they were unlikely to have sufficient insight into the school's context. Additionally, participants working at more than one of the included schools were excluded to avoid conflating responses across school contexts.

All eligible nurses (n = 10) and their respective principals (n = 5) at the participating schools consented to take part in the study. All nurses were women, aged between 41 and 62 years, with a mean age of 51. Their professional experience as school nurses ranged from 2 to 21 years, with an average of 11 years. At their current workplace, they had been employed for between 2 and 17 years, with a mean of 6 years. Among the principals, three were male and two female, aged 42 to 51 years (mean age 43). Their experience in the role ranged

from 1 to 10 years, with an average of 6 years. At their present school, they had held their position for between 1 and 4 years, with a mean of 2 years.

Table 5. School characteristics Study IV.

	School A	School B	School C	School D	School E
Educational profile^a	Vocational and theoretical	Vocational and theoretical	Theoretical	Vocational	Theoretical
School governance	Municipality	Municipality	Municipality	Independent	Municipality
Number of students^b	1100	1500	1500	180	1300
Number of employed nurses	3	3	3	1	2
Number of interviewees	3 nurses, 1 principal	2 nurses, 1 principal	2 nurses, 1 principal	1 nurse, 1 principal	2 nurses, 1 principal

^a type of degree courses

^b at the year-end 2023/2024

Data Collection

Study I

Nurses, managers and policymakers recruited for interviews were contacted via email by MF to schedule a suitable day and time. The interviews, which lasted between 21 and 57 min, were conducted via zoom and audio recorded. Three semi-structured interview guides were used, tailored for each informant group (Appendix I). The guides were developed by the research group and consisted of open-ended questions on experiences of implementing mHealth, the perceived need for and motivation to implement mHealth, as well as perceptions of what was required within the organization to be prepared for implementation. Questions included, for example, “How have you and the child/school healthcare nurses proceeded to use the LIFE4YOUth/MINISTOP in your daily work?” and “What would you and your colleagues need to enable you to implement mHealth, such as LIFE4YOUth/MINISTOP?” and “Why was the decision to implement mHealth made?”. Follow-up questions and probing were used to explore responses in greater depth. The interviews were performed by MF, except for one pilot interview that was conducted by KT. The MINISTOP³¹ and LIFE4YOUth³⁰ were used as illustrative examples of mHealth tools; however, informants were encouraged to reflect on mHealth for health-promoting purposes more broadly. All the interviews were transcribed verbatim.

Study II

The data on organizational readiness for change were collected using the E-Ready questionnaire¹²¹ (Appendix II). The questionnaire, together with sociodemographic questions (confounding factors), was distributed via email to all child healthcare nurses employed at centers that attended a MINISTOP³² educational meeting. The questionnaire was distributed immediately following the meeting.

The E-Ready questionnaire¹²¹ was selected because it was developed within the Swedish healthcare context, with a special emphasis on digital interventions and user-friendliness for healthcare professionals. The E-Ready consists of questions (items) that assess individual healthcare professionals’ perceptions of organizational readiness for implementation both at the individual and collective levels. Totally, the questionnaire comprises 29 questions grouped into six dimensions, see Figure 9. The responses are reported

on Likert scales, tailored to each dimension in terms of both wording and the number of response categories. Five dimensions have a four-point scale (1–4), while one dimension employs a five-point scale (1–5).

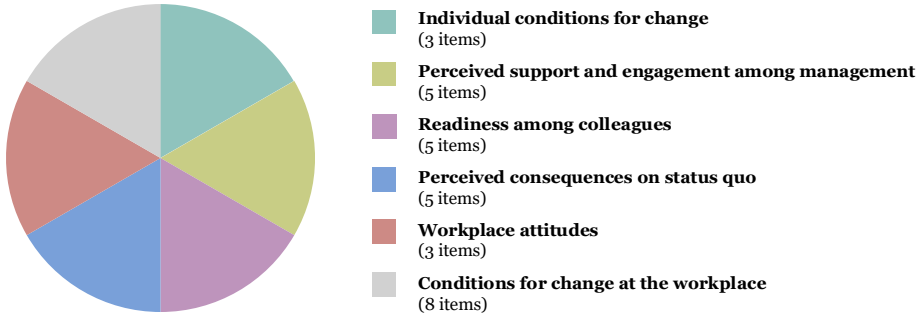


Figure 9. The dimensions included in the E-Ready questionnaire¹²¹.

Adoption was assessed as the number of registrations in the MINISTOP child healthcare interface, obtained from the platform developer. Data on the number of health visits conducted by each nurse between the same period (confounding factor) were collected via an administrative quality system linked to the child health centers’ journal system. The data was provided by the in-house project leader. However, two centers, each with three nurses, did not have access to this quality system. For these centers, the nurses manually calculated the number of health visits based on entries in the journal system.

Study III

Students who had expressed interest in participating in the study were contacted by MF via phone to schedule a suitable day and time for the interview. The students were given the choice between a digital or an on-site interview at their school; 16 students opted for on-site interviews, while 2 chose the digital format. All but one interview was conducted by MF, and the remaining interview was carried out by KT. At one of the schools, it was possible to conduct the interviews during school hours, whereas interviews at the other schools were scheduled after school hours. The interviews took place between 24 hours and 16 weeks after each student’s health visit and lasted on average 21 minutes (range 14 to 31 minutes). All the interviews were audio-recorded and transcribed verbatim. The interview followed a semi-structured guide developed by the research team (Appendix III). The guide was theory-informed and drew inspiration from general determinants of implementation as described by Nilsen⁴⁴. Specifically, it included open-ended questions on influences from 1) the school nurse, 2) the

characteristics of the mobile app, 3) the contextual factors both within and outside the school, 4) the strategies employed by the school to enhance adoption, as well as 5) the student. In relation to these questions, follow-up and probing questions were used to encourage informants to further elaborate on their responses. To facilitate the interview, screenshots of the DSI app and a paper-based version of its content were presented during the session. Although the DSI³³ app was presented as one example of mHealth, the informants were also encouraged to reflect more broadly on determinants influencing the adoption of mental health apps.

The interview guide was pilot tested in five interviews conducted over two sequential days. The reason for conducting as many as five pilot interviews was that one nurse successfully recruited five students and arranged for MF to visit the school during these days. Since the revised interview guide retained all original questions while adding new ones, and the pilot interviews were considered to contain relevant data, they were included in the analysis.

Study IV

Determinants

All nurses and principals at the participating schools were contacted by MF via email to coordinate a suitable time for the interview. Participants were given the option to choose between a digital or on-site interview. In total, thirteen interviews were conducted digitally and two were held on-site. All interviews took place approximately six months after the implementation had begun. The interviews, which lasted between 31 and 70 minutes (mean 49 minutes), were conducted by MF and KT. All interviews were audio-recorded and transcribed verbatim.

Two semi-structured interview guides were developed, one for school nurses and one for principals, based on the CFIR⁴⁹ (Appendix IV). The CFIR domains and constructs were operationalized in accordance with the study (Table 6). Each question in the guide was linked to a specific construct within CFIR⁴⁹, which ensured that the constructs were addressed during interviews. However, to limit the length of the interview guide, six constructs not addressed in Study I were excluded. The questions included in the guides were selected from the publicly available guide on the CFIR website¹²⁷ and adapted to the study.

The interview guides for nurses and principals included similar questions; however, since principals did not use the DSI, their guide contained fewer questions related to the domain “Intervention Characteristics” and did not

include any questions pertaining to “Individual Characteristics”. The guide was pilot tested in one interview with a school nurse. Based on this, the order and wording of some questions were revised. As the pilot interview yielded relevant data for the study, it was included in the analysis. Probes and follow-up questions were used throughout the interviews.

Table 6. Operationalization of the CFIR domains to study IV.

CFIR domain	Study operationalization
Intervention characteristics	Characteristics of the DSI, and how the DSI is perceived by school nurses and principals
Outer setting	External influences on the implementation of the DSI; the students attending the school, influences from other schools, the municipality and society
Inner setting	The schools that are implementing the DSI during health visits
Characteristics of the individuals	Characteristics of the school nurses employed at the schools implementing the DSI during health visits
Process	The process of implementing the DSI during health visits

Adoption

The schools’ adoption levels of the DSI were assessed as the proportion of health visits during which the nurses used the DSI during the health visits within the first six months of implementation, relative to the total number of health visits conducted during the same period, at the school level. This data was obtained from student charts’ and provided by administrative coordinators within each municipality who held an overall responsibility for the charts. However, at one school (School D), which used paper-based charts, it was not possible to retrieve this data in the same way. Instead, the nurse manually tracked the data and reported the information directly to the research team.

Data Analysis

Study I

Study I explored nurses', managers', and decision-makers' perceptions of organizational readiness for implementing mHealth in child and school healthcare. The data were analysed using inductive content analysis as described by Elo and Kyngäs¹⁵¹. The analyses started with all transcripts being read multiple times to gain a sense of the whole. A summary of each transcript was written to get an overall understanding of each interview. Next, words and phrases relevant to the study aim were marked within the text and assigned descriptive codes. Both manifest and latent content were analysed. An abstraction process then followed, during which the data were gradually sorted based on patterns of similarities and differences. Initially, codes were sorted into groups, which were then abstracted into subcategories. These subcategories were subsequently organized into broader categories, which ultimately led to the identification of an overarching main category. The categories were named to reflect the participants' perceptions of readiness for implementing mHealth. All transcripts were independently read, coded, and abstracted by MF and KT, with ongoing discussions involving MF, KT, and UM. The process was iterative and dynamic, with continuous revisions of the abstraction and emerging categories until a shared understanding and consensus were reached. NVivo, version 20 was used to assist the analytic process.

Study II

Study II assessed dimensions of organizational readiness before implementing MINISTOP³² in child healthcare and examined how organizational readiness was associated with nurses' adoption of the intervention.

Psychometric analyses

Given the recent development and limited prior use of the E-Ready questionnaire¹²¹, additional psychometric evaluation was carried out using Rasch analyses¹⁵². According to Rasch measurement theory, the ordinal raw scores derived from the questionnaire may be transformed into interval measures on a logit scale (person measures), provided the data fit the Rasch model¹⁵². Each dimension of the E-Ready questionnaire¹²¹ was analysed independently, as previous research has shown that the different dimensions of E-Ready exhibit only weak to moderate intercorrelations¹²¹. The analyses were

conducted using RUMM 2030 (version 5.8.1), applying an unrestricted polytomous Rasch model.

As logit scales are difficult to interpret in practice, the person measures were rescaled to a 0–10 scale while preserving their linear properties, following the approach described by Ekstrand et al.¹⁵³. Accordingly, a transformed person measure of 0 corresponds to the lowest degree of readiness, whereas a measure of 10 represents the highest. Transformed mean person measures below 4 were classified as indicating a low degree of readiness, a mean between 4 and 6 as medium readiness, and a mean above 6 as high readiness.

Descriptive, correlation and regression analyses

Participant characteristics and the degrees of organizational readiness across the E-Ready dimensions were summarized using descriptive statistics. To examine differences between the starting waves in terms of adoption levels as well as participant and center characteristics, one-way ANOVA was conducted. Following this, Dunnett's T3 post hoc test was applied. Spearman correlation coefficients were employed to explore the correlations between participant characteristics and the frequency of mHealth adoption. To investigate the correlations between participant characteristics and person measures, as well as intercorrelations among person measures across the different E-Ready dimensions, the Pearson correlation coefficient was utilized.

Negative binomial regression models were used to examine associations between organizational readiness across E-Ready dimensions (independent variables) and adoption (dependent variable). The analyses were conducted at the individual level. To account for potential confounding variables, three models were constructed. Model 1 was unadjusted. In model 2, we adjusted for the number of health visits that each nurse conducted during weeks 0 to 19, as well as their clinical experience. In model 3, we made further adjustments for implementation starting wave. Due to the limited number of responders in wave five ($n = 1$), waves five and six were merged. Statistical significance was set at $p < 0.05$ and the analyses were conducted using SPSS version 29.

Non-response analysis

To assess potential differences between nurses who responded to the questionnaire and those who did not, with respect to child healthcare center size, a Mann–Whitney U-test was conducted. Statistical significance was defined as $p < 0.05$. The analyses were conducted using SPSS version 29.

Study III

Study III explored high school students' perceptions of determinants influencing the adoption of a mental health app following health visits. Data analysis was similar to that in Study I, using inductive content analysis according to Elo and Kyngäs¹⁵¹. In addition to being a suitable method for the study's aim, the use of the same analytical approach enabled the doctoral student to take greater responsibility during the analysis process. It also highlighted how different types of data (from both staff vs students) could manifest in different ways. The steps conducted were similar to Study I, involving a thorough reading of all the data, and the assignment of open codes to words and phrases that were related to the study aim. Subsequently, codes were classified into sub-categories, categories and ultimately an overarching main category. The transcripts were read by MF, KT, and MN. MF conducted the initial coding and grouping, which was then discussed with KT and MN until a shared understanding and consensus were reached. Subsequently, MF carried out the abstraction process into sub-categories, categories, and main category. This process was also discussed and revised within the research team (MF, KT, MN, UM). Microsoft Excel was used as a tool to support the analytic process.

Study IV

Study IV aimed to investigate similarities and differences in implementation determinants across schools with different levels of adoption, when a mobile-based mental health promotion tool was introduced during routine health visits in Swedish high schools.

Schools were categorized into three levels of adoption based on data. Schools in which DSI was used in less than 33% of health visits were classified as low-adoption schools. Those with usage between 33% and 66% were classified as medium-adoption schools, whereas schools in which DSI was used in more than 66% of health visits were classified as high-adoption schools.

The qualitative data analysis started with deductive coding, using CFIR⁴⁹ as the analytical framework. We followed the approach outlined by Gale et al.¹⁵⁴, beginning with a familiarization phase that involved reading and/or listening to all interviews to get an overall understanding of the data. Subsequently, two researchers (MF and KT) independently conducted inductive coding on four rich interviews. This step was undertaken to assess whether CFIR⁴⁹ adequately captured the data. After comparing and discussing their findings, the researchers concluded that no additional themes outside the scope of CFIR⁴⁹ had emerged. Therefore, the analysis proceeded using the original structure of the CFIR framework⁴⁹. MF and KT independently conducted the deductive

coding, using guidance provided on the official CFIR website¹²⁷. Data that aligned with CFIR constructs⁴⁹ were assigned corresponding codes. Following the initial coding, MF and KT met to compare their codes, discussing both the content and coding decisions in depth until consensus was reached. NVivo version 20 was used to support the deductive coding process.

After coding of the data, MF developed five case-memos: one for each school. Each memo consisted of written summaries for every individual CFIR construct⁴⁹, accompanied by supporting quotes. Once the case-memos were completed, MF, MN, and KT independently assigned ratings to each CFIR construct within every school, following the procedure described by Damschroder and Lowery¹²⁶. The ratings reflected whether each construct had a positive (+) or negative (-) influence on the implementation, as well as the strength of that influence: 0 (neutral), 1 (moderate), or 2 (strong). A rating of “X” was used when the influence was mixed or when opinions varied, and “M” was assigned when data related to the construct was missing. The researchers compared and discussed their ratings to ultimately reach full consensus on the ratings. The last step involved comparing construct ratings across schools to identify patterns in construct ratings that distinguished schools categorized as low, medium, or high adopters. This comparison was facilitated by a matrix template provided on the CFIR website¹²⁷, which enabled a structured overview of how each construct influenced implementation across different schools. The constructs were categorized into three groups: non-distinguishing constructs, weakly distinguishing constructs, and strongly distinguishing constructs. Non-distinguishing constructs showed no discernible pattern in ratings across schools with low, medium, or high levels of adoption. Weakly distinguishing constructs were characterized by a one-point difference in ratings between schools, while strongly distinguishing constructs exhibited a two-point difference in ratings between low-, medium-, and high-adoption schools. This last step also involved the interpretation of the interrelationships between the CFIR constructs⁴⁹, guided by analytic memos and ongoing discussions within the research team¹⁵⁴.

Ethical Considerations

Study I (ID 2021-02152), II and IV (ID 2022-02957-01; ID 2023-01617-02) have received advisory statements from the Swedish Ethical Review Authority. Such statements are issued when the research falls under the legal definition of research (§2) in the Swedish Ethical Review Act¹⁵⁵, but does not otherwise meet

the criteria defined in §§3–5. These criteria include, among other things, research involving physical interventions, research aiming to influence individuals physically or psychologically, or involving sensitive personal data. Study III underwent ethical review and was approved by the Swedish Ethical Review Authority (ID 2022-05426-01). An amendment application was subsequently submitted and approved (ID 2023-01616-02).

All studies were conducted in accordance with the Declaration of Helsinki¹⁵⁶, which outlines key principles of research ethics, such as informed consent, confidentiality and voluntary participation and minimizing potential risks to research participants. All participants received written information about the study's aim, methods, the responsible researchers, as well as any potential risks. They were informed that participation was voluntary and that they could withdraw from the study at any time. The participants were guaranteed that the data would be treated confidentially and informed about how it would be stored. Written informed consent was obtained in Study II, while verbal consent was documented via audio recordings in Studies I, III, and IV. In Study III, consent was not obtained from guardians. In line with recommendations from the Swedish Ethical Review Authority¹⁵⁷, research participants aged 15-18 should be informed about the research and provide their own consent to participate, provided they have a clear understanding of the implications of the research. To support this, study information in Study III was adapted for this age group by simplifying words and phrases.

To ensure confidentiality, all data were coded, and the code key was stored separately. The data were then stored on a server at Linköping University.

According to the Helsinki declaration (§19-20), vulnerable groups, such as children and adolescents, require special ethical considerations. Including these groups in research is of great importance, but it also comes with greater responsibility; researchers must carefully reflect on ethical issues and consider measures to minimize any stress or burden that the participation might cause¹⁵⁷. In Study III, this was, for example, addressed through close collaboration with the school healthcare services. The participants were informed that they could seek support from these services, if they experienced distress related to their participation. They were also provided with interviewers' contact details for questions or reflections before and after the interviews.

The interviews in Study III prompted me to reflect on the role of young people in research. I became aware of the power imbalance between myself as a researcher and the participants. Although this was not at all intentional, I was assigned a position of greater authority, which potentially make the informants feel uncomfortable or misunderstood and may also result in data that are less rich and trustworthy. Previous research has highlighted power imbalances as

one of the greatest ethical challenges in research involving younger people¹⁵⁸. This imbalance is often inevitable due, among other things, differences in age and experience, and as researchers, we must find ways to acknowledge and address this¹⁵⁹. To foster more equitable relationships, researchers can, for example, work reflexively, create a safe environment, and employ creative methods that enable young people to express themselves more freely¹⁵⁸. In Study III, several measures were taken to help informants feel more comfortable. The interviewer wore casual clothing, initiated the interviews with small talk, and offered Swedish “fika” to create a relaxed atmosphere. Visual aids, such as app screenshots, supported the interviews, and it was emphasized that the researcher was genuinely interested in the participants’ perspectives, with no “right or wrong” answers. Reflexivity was promoted through ongoing research team discussions about how the researcher might influence the interviews.

Students were given the option to participate in either a digital or an on-site interview at their school. Most interviews were conducted at school, and this setting was assumed to be familiar and comfortable for the students. In hindsight, however, conducting the interviews in schools may have reinforced the power imbalance. Schools are hierarchical institutions, with power imbalances between teachers and students. As an adult researcher in this context, I may have been perceived as occupying a “teacher-like” role. Interestingly, the two digital interviews conducted while students were at home were experienced as more relaxed and fostered a stronger sense of safety between researcher and participant. These interviews also yielded richer and more nuanced data.

Results

This chapter is divided into two sections. First, the results of the individual studies are presented (more detailed descriptions can be found in the respective papers). Second, a synthesis of the thesis' main findings is provided.

Study I

The aim of Study I was to explore perceptions among nurses, managers and policymakers regarding organizational readiness to implement mHealth for the promotion of healthy lifestyle behaviours in child and school healthcare. The data showed one main category, four categories and twelve sub-categories (Table 7 and Figure 10).

Table 7. Main category, category and sub-categories Study I.

Main category	Categories	Sub-categories
Trusting conditions for implementation of mHealth	Capability to manage health-related data	Interoperability between data management systems Capacity within data management system Legal and ethical frameworks governing management of health-related data
	Alignment between mHealth and current organizational ways of working	Adapt mHealth content to organizational goals, clinical routines and values Accustom organizational culture to digital working methods
	Governance of mHealth implementation at multiple levels	Clarify the role of mHealth in healthcare Coordinate implementation of mHealth in healthcare Ensure quality of available mHealth interventions Top-down management at clinical level
	Camaraderie within a healthcare team to facilitate use of mHealth in practice	Collaborative approach Opportunities for peer-learning about mHealth Nurturing of respectful and trustworthy relationships

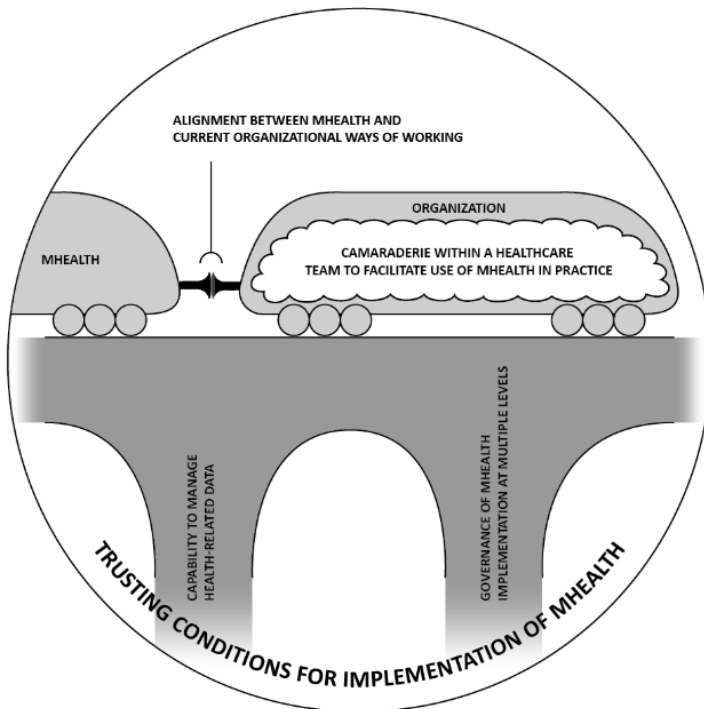


Figure 10. Illustration of the main category and categories, Study I. The four categories contribute to trusting conditions for the implementation of mHealth (main category). Two categories, *capability to manage health-related data* and *governance of mHealth implementation at multiple levels* are cornerstones for organizational readiness and act as dealbreakers for implementation.

Organizational readiness was perceived as having *trusting conditions for the implementation of mHealth*. Four aspects, i.e., the categories, were perceived to contribute to trusting conditions. Two of these, *capability to manage health-related data* and *governance of mHealth implementation at multiple levels*, were identified as dealbreakers, meaning critical prerequisites that must be in place for implementation to proceed. In other words, if an organization lacked readiness in either of these two areas, it was not considered ready for implementation, regardless of its level of readiness in the other two categories. Interestingly, readiness regarding these dealbreakers was generally described as low.

Trust in the organization's *capability to manage the health-related data* generated through mHealth depended on the capacity of existing data systems and their level of interoperability. Being able to manage data also required

navigating and interpreting the legal and ethical frameworks governing health-data, which was described as challenging.

Informants described that governance of *mHealth implementation at multiple levels* contributed to trust by providing clear direction for mHealth implementation. At the national level, informants emphasized the need for guidelines clarifying mHealth's role in healthcare and strategies to ensure the quality of the large number available mHealth tools. At the regional level, governance was perceived to enhance readiness by authorizing mHealth and coordinating implementation efforts. Locally, top-down leadership was considered important. Informants also stressed that, even though principals or primary care managers are their nearest managers, changes are typically mandated by the central school healthcare service or the Child Health Services Councils.

The degree of *alignment between mHealth and current organizational ways of working* was perceived to contribute to readiness. This included how well the mHealth content was adapted to organizational goals, clinical routines, and values. Readiness was strengthened when mHealth was in line with the health-promoting and holistic mission of child and school healthcare, and when its content reflected topics already addressed in clinical routines. Alignment with values such as equity and evidence-based practice was also important and was supported by tools that were research-informed, translated to several languages, and culturally adapted. Organizational ways of working were also expressed in relation to the prevailing organizational culture, that is, informants' perceptions of professional role and identity. Informants described challenges in adapting to digital ways of working, which were still perceived as relatively new in healthcare. Traditional health promotion emphasized trust-based relationships and face-to-face interactions, while digital tools were seen as shifting responsibility to end-users, potentially undermining trust and reducing nurses' sense of control. Moreover, digital interventions sometimes conflicted with professional culture, such as promoting screen-free time and physical activity. The rapid pace of digital development also contrasted with the slower, more stable structures of healthcare. Overall, informants emphasized the need for a gradual cultural shift, where digital approaches become normalized through continuous use over time.

Camaraderie within a healthcare team facilitated use of mHealth in practice and contributed to organizational readiness to implement mHealth. Trustful and respectful team dynamics fostered peer-learning, which in turn built individual trust in its use. This collective approach also supported the development of new routines, such as preparing end-users through informational materials in waiting rooms or appointment letters. When end-

users were informed in advance, it was easier to introduce mHealth during visits. Nurses described shaping visits around end-users' needs and often learning about the tool alongside them. They also noted a reciprocal influence: when nurses felt confident and trusted the tool, end-users were more likely to engage; in turn, positive end-user responses reinforced nurses' motivation to continue recommending mHealth.

Study II

The aim of Study II was to assess different dimensions of organizational readiness prior to the implementation of MINISTOP³² in child healthcare. A further aim was to investigate whether organizational readiness was associated with subsequent adoption (the number of families gaining access to MINISTOP during the first 19 weeks of its implementation).

Organizational Readiness Prior to MINISTOP Implementation

In relation to the first aim, descriptive statistics from the E-Ready questionnaire showed that nurses (n=83) reported varying degrees of readiness across the six E-Ready dimensions, ranging from low to high degrees of readiness (Figure 11).

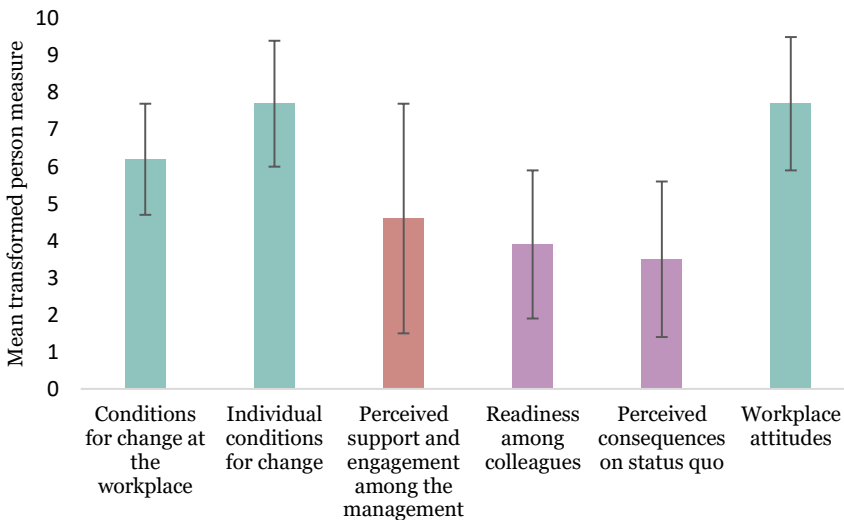


Figure 11. Mean values and readiness degree classifications of transformed person measures for each E-Ready dimension (n = 83). Transformed person measures range from 0 (lowest degree of readiness) to 10 (highest). Means below 4 are classified as a low degree of readiness (marked in purple). Means between 4 and 6 are classified as medium readiness (marked in brown) and means above 6 are classified as a high degree of readiness (marked in green). Error bars represent standard deviation (SD).

Associations between organizational readiness and adoption

The number of registrations made by each nurse in the MINISTOP interface (adoption) during weeks 0 to 19 ranged from 0 to 29, with a median of 2 (IQR 0-6). In relation to the second aim, the negative binomial regression analyses (Table 8) showed no statistically significant associations between organizational readiness, as measured across E-Ready dimensions, and adoption of MINISTOP. However, there was an indication of a trend suggesting that nurses who perceived higher degrees of *readiness among colleagues* made more MINISTOP registrations during the first 19 weeks of implementation (IRR = 1.1, 95% CI: 1.0–1.2, $p = 0.05$). Similarly, nurses who perceived more favourable *conditions for change at their workplace* tended to register more families (IRR = 1.1, 95% CI: 1.0–1.3, $p = 0.08$).

Non-response analysis

The Mann–Whitney U test showed no significant difference in the size of the child healthcare centers where responding and non-responding nurses were employed (median number of employed nurses: non-respondents = 3.0; respondents = 3.5; $p = 0.40$).

Table 8. Results from the negative binomial regression analyses investigating associations between organizational readiness (across each respective E-Ready dimension) and the total number of MINISTOP registrations during the first 19 weeks of implementation.

Variables	MODEL 1 ^a		MODEL 2 ^a		MODEL 3 ^a	
	IRR ^b (95% CI) ^c	p- value	IRR ^b (95% CI) ^c	p- value	IRR ^b (95% CI) ^c	p- value
Conditions for change at the workplace	1.2 (1.0;1.3)	0.03	1.2 (1.0;1.3)	0.02	1.1 (1.0;1.3)	0.08
Number of health visits						
Years of experience in child healthcare			1.0 (1.0;1.1)	0.03	1.0 (1.0;1.1)	0.01
Timepoint for implementation			1.0 (0.9;1.0)	0.13	1.0 (0.9;1.0)	0.20
Wave 1					4.2 (0.9;18.8)	0.06
Wave 2					4.4 (0.9;21.6)	0.07
Wave 3					2.4 (0.2;24.9)	0.50
Wave 4					10.8 (2.1;52.7)	0.003
Waves 5 and 6 (reference)					-	
Individual conditions for change	1.0 (0.9;1.1)	0.82	1.0 (0.9;1.1)	0.97	1.0 (0.9;1.1)	0.95
Number of health visits						
Years of experience in child healthcare			1.0 (1.0;1.1)	0.04	1.0 (1.0;1.1)	0.02
Timepoint for implementation			1.0 (0.9;1.0)	0.08	1.0 (0.9;1.0)	0.14
Wave 1					4.5 (1.1;18.3)	0.04
Wave 2					4.0 (0.9;18.0)	0.07
Wave 3					2.2 (0.2;21.7)	0.49
Wave 4					11.5 (2.6;51.2)	0.001
Waves 5 and 6 (reference)					-	

Perceived support and engagement among management	1.1 (1.0;1.1)	0.21	1.1 (1.0;1.2)	0.19	1.0 (0.9;1.1)	0.94
Number of health visits						0.02
Years of experience in child healthcare			1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.04 0.08	1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.14
Timepoint for implementation						
Wave 1					4.5 (1.1;18.1)	0.04
Wave 2					4.1 (0.9;18.2)	0.07
Wave 3					2.2 (0.2;21.9)	0.49
Wave 4					11.4 (2.5;51.4)	0.002
Waves 5 and 6 (reference)					-	
Readiness among colleagues	1.1 (1.0;1.1)	0.09	1.1 (1.0;1.2)	0.04	1.1 (1.0;1.2)	0.05
Number of health visits						0.01
Years of experience in child healthcare			1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.03 0.05	1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.09
Timepoint for implementation						
Wave 1					4.8 (1.1;21.1)	0.04
Wave 2					4.8 (1.0;23.4)	0.05
Wave 3					2.2 (0.2;22.3)	0.51
Wave 4					12.6 (2.6;60.6)	0.002
Waves 5 and 6 (reference)					-	
Perceived consequences on status quo	1.0 (0.9;1.2)	0.58	1.0 (0.9;1.2)	0.74	1.0 (0.9;1.1)	0.79
Number of health visits						0.02
Years of experience in child healthcare			1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.04 0.10	1.0 (1.0;1.1) 1.0 (0.9;1.0)	0.13
Timepoint for implementation						
Wave 1					4.6 (1.1;18.7)	0.04
Wave 2					4.1 (0.9;18.5)	0.06

Wave 3					2.2 (0.2;21.7)	0.49
Wave 4					11.8 (2.6;53.3)	0.001
Waves 5 and 6 (reference)					-	
Workplace attitudes						
	1.0 (0.9;1.1)	0.50	1.0 (0.9;1.1)	0.46	1.0 (0.9;1.2)	0.72
Number of health visits			1.0 (1.0;1.1)	0.04	1.0 (1.0;1.1)	0.02
Years of experience in child healthcare			1.0 (0.9;1.0)	0.07	1.0 (0.9;1.0)	0.14
Timepoint for implementation						
Wave 1					4.2 (1.0;17.7)	0.05
Wave 2					4.0 (0.9;18.0)	0.07
Wave 3					2.2 (0.2;21.5)	0.50
Wave 4					11.1 (2.50;49.9)	0.002
Waves 5 and 6 (reference)					-	

^aModel 1 was unadjusted. Model 2 was adjusted for each nurse's total number of conducted health visits during weeks 0 to 19 and their years of experience in child healthcare. Model 3 included an additional adjustment for the timepoint for implementation (starting wave).

^bIRR = Incidence Rate Ratio.

^cCI = Confidence Interval; mean plus/minus 1.96 standard errors.

Study III

Study III explored high school students' perceptions of determinants for adoption a mental health app, following routinized health visits in Swedish school healthcare. The data showed one main category, three categories, and eight sub-categories (Table 9).

Table 9. Main category, categories and sub-categories Study III.

Main category	Categories	Sub-categories
Developing my own stance on the mobile app: striking a balance between my beliefs and influence from peers and adults	Alignment between myself and the mobile app	My general beliefs on using mobile apps for mental health promotion
		My prior experience with and preferences for mobile app design
		Recognizing my personal motives to adopt the mobile app
		My trust in the mobile app
	My awareness of the mobile app	Being part of discussions regarding the mobile app
		Publicity around the mobile app
	Having responsive adults in my surroundings	Adults with an openness to talk about mental health
		Adults who care and react to mental health needs

The analyses showed that students' adoption of a mental health app was shaped by their developmental stage, during which they actively formed personal identities, preferences, and values. Adoption emerged as a socially embedded process, where students *developed their own stance on the mobile app by balancing personal beliefs with influences from peers and adults*. Peers served as sources of comparison and inspiration. In contrast, adults, were positioned as reference points to differentiate from, as students emphasized forming independent opinions and preferences.

Perceived *alignment between the student and the mobile app* emerged as a key factor influencing adoption. Students who expressed stronger beliefs about using mobile apps for mental health promotion, such as a greater perceived need for, were seen as more likely to adopt. Prior experiences and design preferences

also played a role; apps resembling those already familiar to students, with simple language and interactive features, were perceived as more engaging and easier to adopt. Recognizing personal motives for adoption was essential, as a recommendation alone was not perceived sufficient. Health visits provided an opportunity for this, particularly when nurses used the paper-based materials to discuss mental health, as well as demonstrating how to download and navigate the app. Students' trust in the app also shaped adoption, influenced by factors such as layout, content familiarity, and trust in the recommenders. Students described that the school nurse's expression of trust in the app influenced students' adoption, while students' feedback was assumed to affect the nurse's willingness to recommend the app further.

Students' *awareness of the app* was seen as a key factor for adoption. Classroom discussions about mental health and the app, preferably led by teachers or school health professionals, were valued for increasing knowledge, interest, and a sense of community. Hearing about the app from various individuals within the school, including staff, signaled that the school was invested in the intervention and took students' mental health seriously. While some students believed publicity around the app, such as posters or social media could promote adoption, others felt such exposure might go unnoticed.

Having responsive adults in their surroundings was also perceived to facilitate app adoption. Their *openness to talk about mental health* fostered a psychologically safe climate, which not only increased interest in a mental health app but also helped normalize mental health conversations more broadly. Students emphasized the importance of *adults caring and reacting to their mental health needs*, for example, by avoiding judgment, building trustful relationships, adapting education to individual circumstances, and guiding them to appropriate support when necessary.

Study IV

The aim of Study IV was to investigate similarities and differences in implementation determinants in schools with different levels of adoption, when a mobile-based mental health promotion tool was introduced during routine health visits in Swedish high schools.

Three schools were classified as low-adoption schools, one school showed medium adoption, and one was classified as a high-adoption school.

Interviews addressed 34 CFIR constructs (Table 10). Of these, 24 were manifested similarly across all schools, regardless of adoption level. The remaining ten constructs distinguished between schools with different adoption

levels. These constructs were primarily associated with the *Outer Setting, Inner Setting, and Process* domains.

Five constructs strongly distinguished schools by adoption level, most of which were interrelated and centred around two key constructs: *Leadership Engagement* and *Students' Needs and Resources*. The perceived presence of *External Policies and Incentives* was also important. The other five constructs were weakly distinguishing, also interconnected, and primarily related to the *Process* domain and *Culture*.

Regarding the medium-adoption school, its construct profile resembled that of the high adoption school in some respects, but that of the low-adoption schools in others. Specifically, it aligned with the high-adoption school in its expression of five constructs, primarily related to **where** implementation took place (at which school), such as *Students' Needs and Resources* and schools' *Culture*, with its interrelated constructs. In contrast, it resembled the low-adoption schools in constructs related to **how** implementation was carried out, such as those within the *Process* domain and *Leadership Engagement*, again with their interrelated constructs.

Below is a summary of how each CFIR construct was manifested across the schools.

Table 10. Constructs that strongly, weakly or did not distinguish schools with different adoption levels, Study IV.

CFIR Domain	CFIR Construct	Strongly Distinguishing Construct^a	Weakly Distinguishing Construct^b	Non-Distinguishing Construct^c
Intervention Characteristics	Intervention Source		✓ ^d	
	Evidence Strength and Quality			✓
	Relative Advantage			✓
	Adaptability			✓
	Triability			✓
	Complexity			✓
	Design Quality and Packaging			✓
Outer Setting	Students' Needs and Resources	✓ ^d		
	Cosmopolitan			✓
	Peer Pressure			✓
	External Policies and Incentives	✓ ^d		
Inner Setting	Network and Communications			✓
	Culture		✓ ^f	
	Tension for Change			✓
	Compatibility			✓
	Relative Priority	✓ ^d		
	Goals and Feedback	✓ ^e		
	Learning Climate			✓
Leadership Engagement	✓ ^e			

Results

Available Resources	✓
Access to Knowledge and Information	✓
Characteristics of the Individuals	
Knowledge and Belief about the Intervention	✓
Self-efficacy	✓
Individual Stage of Change	✓
Individual Identification with the Organization	✓
Process	
Planning	✓ ^e
Opinion Leader	✓
Formally Appointed Internal Implementation Leaders	✓
External Change Agents	✓
Key Stakeholders	✓ ^e
Reflecting and Evaluating	✓ ^e

^a A difference of two or more rating units in the construct ratings between schools with different adoption levels

^b A difference of one rating unit in the construct ratings between schools with different adoption levels

^c The construct was manifested similarly in schools with different adoption levels with no discernible pattern in the ratings

^d The construct distinguished low-adoption schools from medium- and high-adoption schools

^e The construct distinguished low- and medium-adoption schools from the high-adoption school

^f The construct distinguished low-adoption schools from the high-adoption school

Intervention Characteristics

Low-adoption schools described the *intervention source* (weakly distinguishing construct) of the DSI as externally developed by the research team. In contrast, medium- and high-adoption schools reported having sought information about the DSI prior to the project's launch and expressed a stronger sense of internal ownership. This construct was closely linked to culture, as hierarchical organizational cultures led school nurses to search for top-down guidance, such as evidence-informed knowledge. All schools perceived the *evidence strength and quality* of the DSI to be satisfactory. Although none had accessed empirical findings, the app was seen as evidence-informed because it included familiar facts, and the credibility added by researcher involvement. The DSI was perceived to offer a *relative advantage* by simplifying mental health discussions during health visits. Nurses valued the app's accessibility for students and its ability to streamline their workflow by reducing reliance on printed materials and external websites. The paper-based DSI tool was found to be highly *adaptable* to individual student needs during health visits, while the app's fixed structure was appreciated for preserving its evidence-informed content. The *trialability* of the DSI was perceived as high, with nurses able to test it during selected visits before full implementation. The DSI was generally perceived as low in *complexity*, with good *design quality and packaging*; user-friendly, clear, and easy to understand. The self-screening component was particularly appreciated for its clarity and helping students visualize their life balance. However, nurses at some schools wished the app were more engaging and interactive.

Outer Setting

Schools expressed that *students' needs and resources* (strongly distinguishing construct) varied somewhat between schools, as did how well the DSI met those needs, as well as the feedback nurses received from students. While all nurses generally expected the DSI to address common student needs, such as high levels of screen-time and sleep issues, low-adoption schools experienced low student engagement and motivation, as well as sparse feedback. In contrast, medium- and high-adoption schools observed that students often experienced increased pressure, due to expectations in academic performance, sports and work during free time. In these schools, the DSI was perceived as better aligned with student needs, and the paper-based tool was used more broadly to help students reflect on life balance. Although direct feedback was limited, nurses noticed increased student awareness during visits.

Cosmopolitan was seen as important for staying inspired and updated with new knowledge. Most nurses participated in regular municipal networks, while one school had limited external professional connections. Awareness that other schools in the network were implementing the DSI, created a form of *peer pressure* that facilitated the implementation. However, the network mainly encouraged initial implementation rather than supporting ongoing use or experience-sharing.

The perceived presence of *external policies and incentives* (strongly distinguishing construct) facilitated implementation. The construct was closely linked to the construct culture as schools with hierarchical organizational cultures welcomed top-down guidance, increasing their receptiveness to external guidelines. In medium- and high- adoption schools, nurses viewed the central school healthcare organizations as a key source of professional guidance. Although these organizations did not provide explicit guidance for implementing the DSI, its authorization was perceived as implicit approval. In contrast, low-adoption schools felt a lack of external guidance, even when they had access to the same policies.

Inner Setting

The *structural characteristics* varied by schools' type of organization, size and age. Four municipally operated schools employed multiple nurses. One low-adoption school differed by being newer, smaller, privately operated, and staffed by a single part-time nurse. Medium- and high-adoption schools also differed from low-adoption ones by offering only theoretical programs, having long-standing traditions, and being located in prestigious, historic buildings.

The structure of *networks and communication* was shaped by the school organization. In schools with multiple nurses, three distinct network levels were identified: among nurses, within the school healthcare team, and with teaching staff. Nurses met daily or weekly through both formal meetings and informal interactions, and their collaboration was generally described as positive. The school healthcare teams also met weekly, though the quality of collaboration varied. Some teams experienced interpersonal tensions and differing professional views on student needs. Meetings with teachers were more sporadic, often limited to a few times per term, which was perceived to hinder close collaboration in health-promoting efforts. In the school with only one nurse, the same layered network was not described. Instead, all school staff were considered the nurse's closest colleagues. The school healthcare team met weekly, while meetings with teaching staff occurred biweekly. A *culture* (weakly distinguishing construct) of openness to change, collaborative interprofessional approach and shared understanding of the health promotion mission generally

facilitated the implementation and was described in all but two schools (low and medium adoption). In those two exceptions, a strong professional pride among teachers and school healthcare team created a culture that hindered collaboration. Interestingly, schools with medium and high adoption levels shared additional cultural traits that set them apart from schools with low adoption. These included more hierarchical structures, where change was typically driven top-down. In the high-implementation school, new approaches were expressed to be more readily accepted when backed by evidence, rather than personal motivation or emotional appeals. Since the DSI was both perceived to be introduced from the top and evidence-based, the existing culture facilitated its uptake.

Tension for change was reflected in several schools' recognition of the urgent need to address the growing issue of mental health problems among adolescents, as well as to keep pace with the rapid digital development in society. The DSI was perceived to be highly *compatible* with existing goals, routines and ways of working, which facilitated its implementation. The *relative priority* (strongly distinguishing construct) for introducing students to the DSI was described as high in medium- and high adoption schools. Nurses in these schools routinely used the tool in a health-promoting way, perceiving a broad student need. In contrast, in low adoption schools, the DSI was only prioritized when clear need was identified. The tool was perceived to compete with other topics that needed to be addressed during the health visits or was met with low student engagement. This construct was therefore closely linked to the construct Students' Needs and Resources.

Goals and feedback (strongly distinguishing construct) were communicated only at the high-adoption school, where the principal aligned the DSI with the school's systematic quality work. In medium- and low-adoption schools, no goals for the DSI implementation were communicated. This construct was linked to leadership engagement, as principals were viewed as responsible for communicating implementation goals. A *learning climate* was described in schools where principals actively involved staff in change processes and there was time for reflection, fostering a sense of psychological safety and willingness to try new ways of working.

Leadership engagement (strongly distinguishing construct) was perceived as evident in the high-adoption school, where the principal was described as engaged in school healthcare efforts and had initiated several development efforts. In contrast, principals in low- and medium-adoption schools were perceived generally supportive and approved initiatives such as the DSI. But their involvement rarely extended beyond initial endorsement. School nurses felt they were left with full responsibility for leading and managing the

implementation on their own. In all schools, nurses expressed a high degree of autonomy and carried out their work with independence. There was also a shared recognition that schools are primarily educational institutions, and that leadership, first and foremost, should focus on teaching-related matters.

In all schools, *available resources* were perceived as sufficient in terms of time during health visits, allowing space to introduce the DSI. However, time outside the health visit, needed to familiarize themselves with the materials, drive implementation, and engage students, was limited. Technical resources were also constrained, such as a lack of work phones or tablets to demonstrate the app to students. All school nurses had *accessed knowledge and information* about DSI by taking part in the education and material distributed by the research team. This was generally perceived as sufficient, although some schools expressed a need for further education.

Individual Characteristics

Knowledge and beliefs about the DSI were described with positive statements and attitudes towards the paper-based tool. Views on the app component were more mixed. On one hand, the app was seen as accessible and well-suited to the students' age group. On the other hand, its effectiveness was perceived to depend heavily on the student's motivation to use it. Nurses also noted that face-to-face visits allowed for more personalized guidance than a digital tool could offer. Additionally, concerns were raised about sending mixed messages, as they simultaneously recommend reduced screen time, and feared the app might be overlooked among many others on students' devices. Nurses generally reported high *self-efficacy* using the DSI. Regarding *individual stage of change*, most nurses stated that they felt confident in their use of DSI, but at the same time emphasized that they were at the beginning of their development process. This experience reflected the fact that the implementation was still considered to be in an early stage. All school nurses expressed a strong *individual identification with the organization* by describing a deep commitment to their profession and a strong motivation to improve students' health.

Process

Planning (weakly distinguishing construct) across professional boundaries were perceived to facilitate implementation. At the high adoption school, initial plans were made to implement the broader school-based DSI program (not included in this study)¹³². To prepare, the school healthcare team, including the principal, structured and coordinated the implementation across professions. Although the broader implementation was discontinued, school nurses continued planning for using DSI during health visits, planning for how to

integrate it and communicate to teachers, mentors, and students. In contrast, planning in medium- and low-adoption schools was carried out solely by school nurses, without active involvement from principals or other staff. One low-adoption school reported no planning at all, with nurses introducing the DSI spontaneously during routine visits.

Opinion leaders were described as other professionals such as mentors, teachers, and school counsellors. Their involvement was considered important due to their frequent contact with students, which enabled them to engage students. Schools varied in how actively these professions were involved, as well as in how successful they were in engaging the opinion leaders. *Formally appointed internal implementation leaders* were present at two schools, selected by principals or school healthcare teams, and their presence were perceived to facilitate the implementation. At other schools, no one held clearly defined formal responsibility. At several schools, nurses had a role as *champions*, actively promoting the DSI implementation. No schools reported involvement of *external change agents*, nor did they express an opinion on whether the absence had a positive or negative impact on the implementation.

School nurses were *key stakeholders* (weakly distinguishing construct), as they introduced DSI to students during health visits. Nurses at all schools received the same implementation strategies from the research team, including an educational meeting and distribution of supporting materials. However, at the high adoption school, the nurses had engaged more deeply with the material while preparing for the broader school-based DSI project (not included in this project)¹³². Together with the school healthcare team, joint sessions were held involving watching videos and discussing the content. Even though the implementation didn't continue past that phase, they perceived that a cross-professional strategy helped supported nurses' engagement in the DSI.

To engage *innovations participants*, i.e., the students, both during and outside of the health visit was considered crucial to successfully implement the DSI. During the health visits, strategies, such as using a laminated version of the paper-based tool to visualize mental health, as well as demonstrating the app, were used to foster engagement. In some schools, no engagement efforts were made outside the health visit, which was seen as a barrier. Other schools engaged students by sharing information about the DSI during teaching hours, putting up posters, and posting information on schools' intranet.

Reflecting and evaluating the implementation (weakly distinguishing construct) was perceived to facilitate implementation. In schools with low or medium levels of adoption, this was done through informal conversations among school nurses. In contrast, the high adoption school included evaluation

as part of its structured quality assurance process, carried out in collaboration with school leadership.

Synthesis of Thesis' Main Findings

This section provides a synthesis of the main findings (Figure 12). To enhance comparability and clarity, the findings are organized into two phases, reflecting the phase of the implementation process addressed in each study. The *preparation phase* includes Studies I and II, exploring organizational readiness prior to or in early stages of implementation. The *implementation phase* covers studies III and IV, focusing on determinants during the actual implementation process. The CFIR domains⁴⁹ are applied to describe and organize the findings. The operationalization of the CFIR domains⁴⁹ is similar to Study IV but adapted to encompass both child and school healthcare settings (Table 11). The wording and structure of the individual study findings have been slightly adapted to align with the synthesis.

Table 11. Operationalization of the CFIR for synthesizing the thesis' main findings.

CFIR domain	Operationalization
Intervention characteristics	Characteristics of the mHealth tool and how it is perceived by child and school healthcare nurses
Outer setting	External influences on the mHealth implementation, including the students attending the school and families served by the child healthcare center, as well as influences from other organizations, the municipality and society
Inner setting	The schools and child healthcare centers that are implementing the mHealth during health visits
Characteristics of the individuals	Characteristics of the nurses employed at the schools and child healthcare centers implementing mHealth during health visits
Process	The process of implementing mHealth during health visits

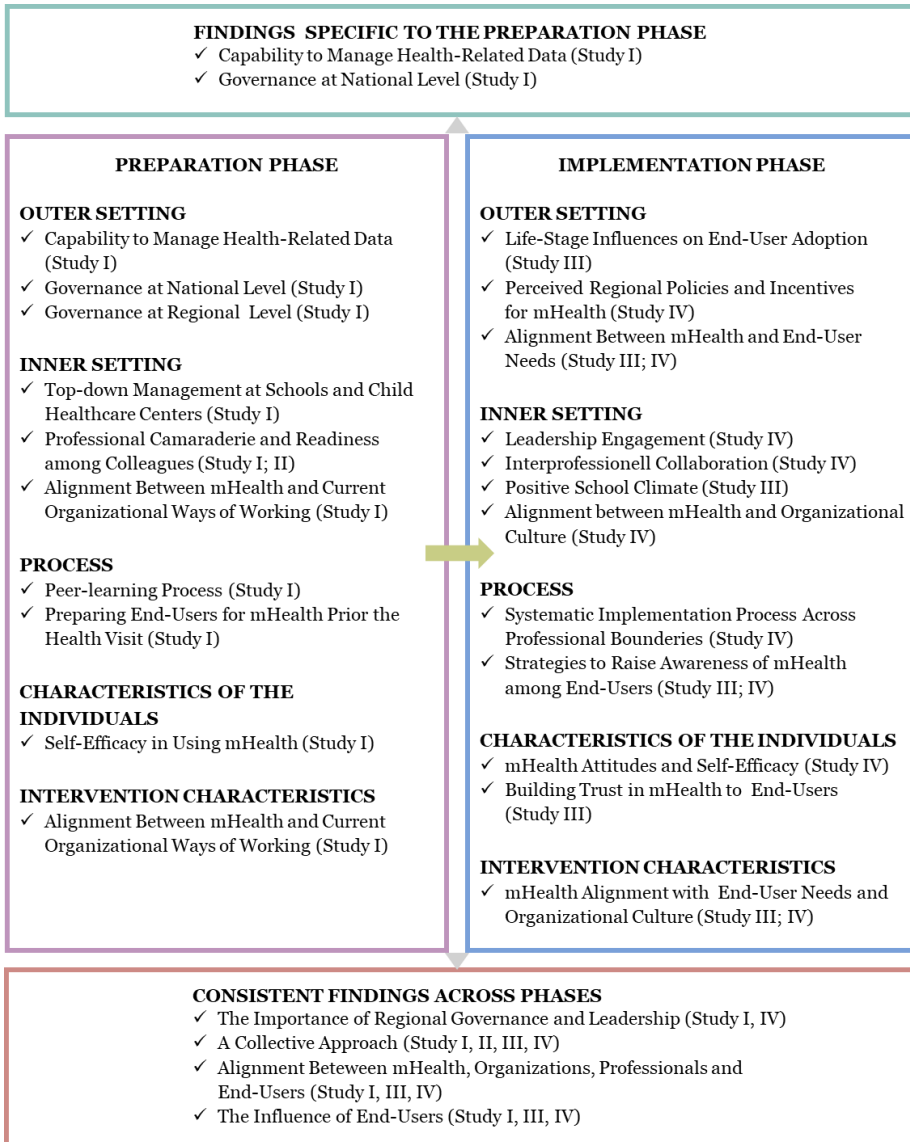


Figure 12. Synthesis of main findings. The “Preparation Phase” synthesizes findings from Studies I and II, and the “Implementation Phase” synthesizes findings from Studies III and IV. “Findings specific to the preparation phase” highlights result unique to and only observed during the preparation phase, whereas “Consistent findings across phases” presents findings identified in both the preparation and implementation phases.

Findings Related to the Preparation Phase

Studies I and II, conducted during the preparation phase, examined organizational readiness for implementing health-promoting mHealth in child healthcare (Studies I and II) and in school healthcare (Study I). While addressing the same phenomenon, the studies employed different designs and methodological approaches, offering a valuable basis for comparison.

Study I found that organizational readiness for implementing health-promoting mHealth was perceived as having trusting conditions for the implementation. While several aspects contributed to these conditions, two aspects emerged as particularly central, both, interestingly, associated with the outer setting. One concerned the capability to manage health-related data generated through mHealth, requiring interpretation of legal frameworks, technical standards, and sufficient capacity and interoperability within the organization's data management system. The other involved the need for national governance to clarify the role of mHealth in healthcare. Additionally, Study I showed that readiness was supported by governance at the regional level, such as the Child Health Services Councils and central school health organizations, which authorized the use of mHealth and coordinated implementation efforts.

Study I also showed that organizational readiness was influenced by aspects related to the inner setting, a focus further explored in Study II. In study II, child healthcare nurses generally expressed positive attitudes toward the implementation and reported high levels of readiness, both in terms of workplace conditions (e.g., access to resources, support, and training) and individual factors (e.g., competence and confidence in using mHealth). Both studies emphasized the importance of camaraderie and readiness among colleagues for organizational readiness to implement mHealth. In Study I, team camaraderie was perceived to support peer learning, strengthen mHealth-related self-efficacy, and facilitate the development of new implementation routines, where preparing end-users for mHealth prior to the visit was stressed as particularly relevant. However, Study II showed that perceived readiness among colleagues, such as engaging in joint discussions about the implementation and sharing responsibility for it, was generally low. This may partly explain the limited adoption of MINISTOP observed in Study II, alongside the fact that adoption was measured at an early stage of the implementation process.

Study I also highlighted the need for top-down management from local managers to strengthen readiness. Nurses often felt their roles were peripheral to the broader mission of their organizations. Study II showed that managerial

support was generally rated as moderate, with higher ratings reported by nurses at larger centers.

Finally, the studies highlighted aspects related to compatibility with the intervention: mHealth tools whose content aligned with the organizational ways of working, such as goals, routines and values of child and school healthcare enhanced organizational readiness (Study I). However, Study I also identified challenges in aligning organizational cultures, regarding professional roles, identities, and the use of digital tools for health promotion. These findings were confirmed in Study II, where nurses reported low readiness in relation to how mHealth influenced their daily work, especially among those with longer professional experience. Study I suggests that organizational culture may need time to gradually adapt to digital practices to strengthen future readiness for implementation.

Findings Related to the Implementation Phase

The studies conducted during the implementation phase examined the implementation of a mHealth tool to promote mental health during health visits in high schools, but from different perspectives. Study III examined determinants for app adoption from the students' point of view, while Study IV focused on implementation determinants from the perspectives of school nurses and principals.

Findings from these studies suggest that key determinants are associated with the outer setting. For example, study IV showed that perceived governance at the regional level, such as the presence of policies and incentives for health-promoting digital tools within central school health organizations, supported the implementation. Furthermore, study III revealed that students' adoption of mHealth unfolded as a socially embedded process influenced by the life stage, in which they formed personal opinions about the mHealth tool by relating it to others in their surroundings.

Another main finding from Study IV was that the specific needs of students at each school, and the extent to which these needs were met by, and aligned with the mHealth tool, played a crucial role for implementation success. This was supported by Study III, which showed that students' adoption of the app was perceived to be facilitated when it aligned with their individual needs and preferences.

Regarding the inner setting, findings from Study IV indicated that the implementation effort had a student-centred focus, with much of the process revolving around students as a central hub. Strategies to raise awareness of mHealth among students extended beyond health visits, involving other

professionals, such as teachers, to promote the tool. This approach reflects a recognition of students' needs in health promotion. Indeed, study III showed that increased awareness and classroom discussions about mental health and the app were perceived to facilitate adoption among students.

Study IV further showed that the implementation of health-promoting mHealth was viewed as a shared responsibility across the school, even though the recommendation itself was delivered during the health visit. An interprofessional collaboration culture, with an openness to change and shared understanding of the health-promoting mission, supported the implementation. Likewise, a supportive school climate with responsive school professionals was perceived to facilitate students' adoption of mHealth (Study III). Furthermore, study IV highlighted that an organizational culture aligned with the characteristics of the mHealth tool further contributed to successful implementation.

One of the key findings from Study IV underscored the importance of leadership engagement in both the implementation process and the school's broader health-promoting mission. Leadership played a central role in enabling process-related factors associated with successful implementation, such as communicating goals, supporting planning efforts, creating conditions for key stakeholder engagement, and evaluating the implementation. Moreover, the findings indicated that these process-related factors had a greater impact when applied across professional boundaries, for example, in collaboration with the school healthcare team, rather than being confined to school nurses alone.

Comparison of Findings Across Phases

Although the studies conducted across the different phases employed varying methodologies, theoretical approaches, and, to some extent, contexts, it is nevertheless valuable to compare both the differences and similarities in findings across the phases (Figure 13).

Two findings were prominent in the preparation phase but not observed in the implementation phase: the capability to manage health-related data and the need for national governance. As shown in Study I, both were identified as dealbreakers for organizational readiness to implement mHealth.

At the same time, several findings were consistent across phases, highlighting factors important throughout the implementation process. First, regional governance from the Child Health Services Councils and central school health organizations, as well as leadership from the inner setting was consistently highlighted, encompassing the provision of direction and

coordination, monitoring the implementation and fostering a shared understanding of goals. Furthermore, alignment emerged as a recurring theme, referring to the complexity of aligning the mHealth tool with the organization, professionals, and end-users involved. The mHealth implementation was largely a collective approach involving collaboration, relationship-building, and shared learning among nurses, as well as between school healthcare teams and other school professionals. The significance of end-users was highlighted throughout, as the implementation process was largely shaped around their needs, with end-users acting as active agents directly influencing both the process and the outcomes of implementation. These findings, specific to the preparation phase and consistent across phases, are further discussed in the following section.

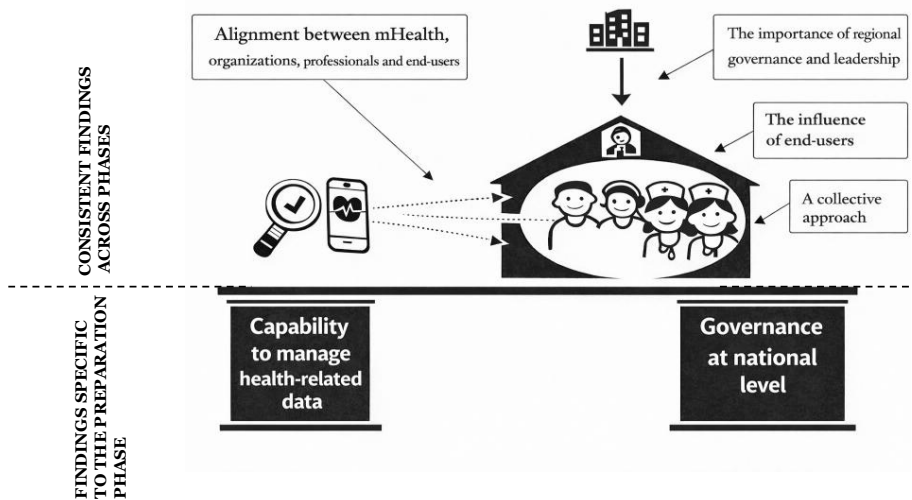


Figure 13. Illustration of main findings. The capability to manage health-related data generated by mHealth, as well as governance at the national level, were findings found to be specific to the preparation phase and functioned as deal-breaking factors for enabling mHealth implementation. Four findings were shown to influence mHealth implementation across both the preparation and active implementation phases: the importance of regional governance and leadership, and alignment between the mHealth tool and the organization, professionals, and end-users. Further, implementation required a collective approach among professionals, and the implementation process were centred around, and carried out together with, the end-users. Image generated with AI (ChatGPT, 2026).

Discussion

Result Discussion

The overall aim of this thesis was to generate knowledge about the implementation of mHealth interventions that support health promotion practices during routine health visits in Swedish child and school healthcare.

Overall, the findings indicate that implementation of mHealth is not a matter of simply “adding an app” into a health visit. Rather, implementation involves contextual factors operating at multiple levels within and outside child and school healthcare organizations. While some factors appear to be influential throughout the implementation process, others seem to play a particularly critical role during the preparation phase prior to actual implementation. These findings provide novel insights into how mHealth may be integrated into routine practice; a field in which previous research has largely focused on the individual professional perspective and technological features²⁵⁻²⁹.

Reflections on Findings Specific to Preparation Phase

Associated with the outer context, two factors were identified as dealbreakers for organizational readiness to implement mHealth during the preparation phase. Without adequate data management capability within the organization or appropriate national governance, child and school healthcare services were not perceived as ready for implementation, even when other aspects, such as alignment between the mHealth and organizational routines, or camaraderie with the team, demonstrated high readiness (Study I).

These findings offer new and valuable insights into organizational dealbreakers for mHealth implementation, as many previous studies have focused primarily on the implementation phase^{25-29, 77, 116}, thereby overlooking contextual considerations that may be important earlier in the process. An earlier review similarly shows that much implementation research focuses on the implementation phase, while giving less attention to other phases, such as exploration, preparation, and sustainment⁵¹.

Capability to Manage Health-Related Data

Findings from Study I indicate that readiness requires child and school healthcare organizations to have the capability to securely manage the health-related data generated by mHealth tools. This is consistent with previous

literature on eHealth readiness, where technological readiness, i.e., the healthcare organization's ability to meet all the technological requirements to get the system up and running, is identified as the most frequently used construct to assess eHealth readiness¹⁰⁸. Technical infrastructures have even been described as "*the backbone of digital readiness*"¹⁰⁹.

At the same time, the findings highlight challenges related to integrating and managing mHealth data within existing data management systems (i.e., medical records), related both to storage capacity, as well as system interoperability (Study I). Such challenges are well documented in previous mHealth implementation research²⁵⁻²⁹. In Sweden, these barriers are further exacerbated by the fact that medical records differ both across regions and between municipalities, meaning that each system requires their own specific adaptations^{134, 160}. Paradoxically, the use of mHealth itself increases the demand for interoperability, as many mHealth tools are small-scale and therefore require flexible data management systems capable of meeting the requirements of individual tools (Study I). The Swedish eHealth Agency is currently exploring a national digital infrastructure, aiming at improving data sharing across healthcare actors; a development that could be a game-changer for the implementation of mHealth in the future¹⁶¹.

External data storage, such as cloud-based platforms or external service providers, were described as potential alternatives for managing mHealth data (Study I). However, when these tools were not integrated into existing medical records, they risked becoming "add-ons" that increased workload, particularly when several tools are used for different purposes (Study I). They also require professionals to rely on third parties for secure data storage. In line with Study I, previous research consistently highlights that trust in data security is central to professionals' mHealth adoption²⁵⁻²⁹.

Legal and regulatory frameworks further influenced organizations perceived capability to manage mHealth data (Study I). However, Study I showed that regulations governing health-related data were often perceived as complex and difficult to interpret, leading decision-makers to hesitate or refrain from implementation. Similar concerns have been raised in earlier mHealth research²⁵ and are echoed in a report from the Swedish eHealth Agency mapping the prerequisites for health applications. The report emphasizes that the regulatory landscape for health apps is complex and difficult to apply in practice, and that implementation decisions are impeded by procurers' limited capacity to assess whether the interventions meet relevant quality and legal requirements⁹⁴. Furthermore, the report describes challenges for mHealth researchers and mHealth developers in navigating legal frameworks and technical requirements necessary to make mHealth "implementable", however

also emphasizes that such considerations need to be addressed already during the development of the tool⁹⁴. Similar conclusions are drawn from L f and Maddison¹⁸, who in a commentary article propose recommendations for researchers to consider for successful implementation of mHealth tools. The authors emphasize the need to “future-proof” mHealth by adopting flexible data-storage solutions and considering how data should be stored even beyond the research context. In Sweden, there is an ongoing national initiative aiming to increase awareness of a framework for the quality assurance of mHealth^{160, 162}. This framework is intended to support decision-makers and procurers in assessing the safety and quality of mHealth tools, while also providing guidance to developers on how a mHealth tool may be designed to ensure sufficient quality for implementation within healthcare. Such a framework is likely to be particularly relevant within school healthcare services, where decision-makers are not accustomed to handling health-data in the same way as in healthcare.

From a theoretical perspective, no construct within CFIR⁴⁹ explicitly captures an organization’s capacity to manage health-related data. However, viewed through the lens of the ORC theory⁶¹, these findings can be understood in terms of *change efficacy*, which reflects organizational members’ shared belief in their collective capability to implement a change. According to the theory, change efficacy depends both on whether members understand what is required for implementation, and whether they have the necessary resources to implement it. The findings suggest that complex legal frameworks governing health-related data created uncertainty about implementation requirements. At the same time, limited storage capacity and insufficient interoperability within existing data systems restricted the resources available to support implementation. Overall, this resulted in low change efficacy for the implementation of mHealth in child and school healthcare.

National Governance

Findings from Study I suggest that national governance is a dealbreaker for organizational readiness to implement mHealth tools. The informants described uncertainty regarding the role of mHealth in healthcare practices and whether it should be prioritized, a finding that echoes previous research identifying unclear governance as a barrier to healthcare providers’ adoption of mHealth tools^{25, 26}. This also aligns with the World Health Organization’s Global Strategy for Digital Health, which emphasizes the need for robust governance structures to guide and support digital health initiatives⁸⁷. Together, these findings suggest that without national governance, mHealth implementation risks being optional rather than an integrated part of healthcare practices, leaving implementation

dependent on individual staff engagement rather than on organizational commitment²⁶.

In Study I, informants also highlighted the lack of national coordination regarding the quality assurance of mHealth tools. They described being left on their own to identify suitable mHealth tools and assess their evidence base and data security. This contrasts with other countries, such as Germany, the UK and the Netherlands, where national “app libraries” or similar systems provide quality-assured mHealth tools for healthcare use⁹⁴. Previous research suggests that such forms of “stamp of approval” may increase professionals’ willingness to recommend mHealth tools to end-users, by signaling that the tools are legitimate and safe for use within the healthcare system^{163, 164}.

The importance of governance is also reflected in implementation TMFs. Within the CFIR framework⁴⁹, national governance aligns with the outer setting construct *External Policies and Incentives*, which captures how implementation is influenced by external strategies such as regulations, policies, mandates, and guidelines. From an ORC⁶¹ perspective, these findings can be understood in terms of *change commitment*, that is, organizational members’ shared resolve to implement a change. Change commitment depends on whether a change is perceived as important, legitimate, and worthwhile. In this context, the perceived lack of national governance appeared to weaken such commitment by creating uncertainty about whether mHealth implementation was truly valued and prioritized at the national level.

The low readiness regarding national governance reported in Study I is particularly noteworthy in light of Sweden’s national policy ambition over the past decade. For example, in 2016, a national goal was set for Sweden to become world leader in healthcare digitalization by 2025, and digitalization has since been positioned as central to the national reform “Good and Close Care”⁸¹. The findings of this thesis consequently suggest a gap between these high-level policy ambitions and professionals’ experiences of governance in everyday practice, a misalignment that has also been identified in previous research on digital health implementation in the UK¹⁶⁵. In Sweden, this challenge may be further reinforced by the system of municipal and regional self-government, whereby regions and municipalities have substantial autonomy in determining how national policies are implemented and which strategies and resources are prioritized, potentially resulting in considerable variation across regions and municipalities.

Meanwhile, substantial research funding has been invested in developing and evaluating mHealth interventions¹²⁻¹⁶. Nevertheless, only a limited number of such interventions have been implemented in routine practice^{17, 18, 103}. Indeed, this gap may reflect the “deal-breakers” identified in this thesis, underscoring

how difficult it is for mHealth tools to move beyond the preparation phase of implementation. From an ethical perspective, this raises questions about whether continued research investment is justified when organisations perceive that they lack the capacity or governance to implement them¹⁶⁶. When fundamental prerequisites are missing, new technologies risk generating frustration rather than improved care. At the same time, these challenges must be understood in the context of the rapid technological development of recent decades and the substantial demands this place on society and welfare sector organisations. As one informant in Study I wisely expressed it, digitalisation in healthcare requires us to “lay the tracks while we are already walking on them”.

Reflections on Findings Consistent Across Phases

The Importance of Regional Governance and Leadership

Regional Governance

Findings highlighted the critical role of regional governance, such as from the Swedish Child Health Councils and central school health organizations throughout the implementation process (Study I, IV). These regional actors were described as legitimizing mHealth implementation by providing profession-specific guidance and by coordinating implementation efforts across regional and municipal boundaries. In doing so, they helped structure implementation processes and reduce variation between organizations. From an ORC perspective⁶¹, this suggests that regional governance may enhance both change efficacy and change commitment. By providing structured coordination and clear guidance, regional actors can strengthen staff perceptions of their collective ability to implement mHealth, thereby supporting *change efficacy*. At the same time, when nurses perceive that mHealth is valued, prioritized, and endorsed by actors with professional authority, their *change commitment* to engage in implementation is reinforced.

Several factors may help explain the prominent role of governance in the implementation of mHealth in child and school healthcare. One factor is that, compared with more traditional implementation objects, the digitalization of healthcare represents a paradigm shift that challenges established professional cultures and ways of working. This, in turn, may increase the need for governance structures that can clarify the role of mHealth, provide shared direction, and legitimize implementation efforts (Studies I, IV). Another factor relates to the specific organizational contexts examined in this thesis. Both child and school healthcare operate within larger systems; primary care and schools, respectively, where health-promoting objectives must be balanced against

broader medical and educational priorities. In these contexts, there is a risk that smaller professional groups, such as child and school healthcare nurses, become overshadowed by governance structures for larger professional groups, such as primary care or pedagogical staff^{137, 167}. Such organizational structures may further increase the need for profession-specific governance that explicitly addresses the conditions and responsibilities of child and school healthcare nurses. Previous national studies support this interpretation by highlighting the guiding role of the Child Health Care Councils for child healthcare nurses¹⁶⁸ and the importance of central school healthcare organizations for school nurses¹¹⁰.

Leadership Within the Inner Context

One prominent finding of the thesis was the importance of engaged leadership within the inner context, i.e., primary care managers and school principals (Studies I and IV). The implementation of mHealth emerged as a complex process, with leadership playing a critical role in clarifying implementation goals, establishing structures for systematic implementation activities within and across professional groups, and fostering a collaborative organizational culture which supported implementation (Studies I and IV).

The importance of leadership for implementation is well established in previous research, both in relation to evidence-based practice in general¹⁶⁹, mHealth implementations targeting adults with chronic conditions^{25, 28, 29} and in the limited body of research examining mHealth implementation within child and school healthcare^{77, 116}. For example, Beames et al.⁷⁷ found that leadership involvement was essential for planning implementation and engaging key stakeholders in the implementation of a mHealth intervention aiming to prevent depression among children in Australian schools.

Specifically, Study IV found that the high adoption school had a principal who actively prioritized both the health-promoting mission and the mHealth implementation. This principal aligned implementation goals with school's broader objectives, thereby creating legitimacy for implementation and clarifying organizational priorities. In addition, this principal enabled a structured implementation processes across professional roles, including implementation planning, shared forums for stakeholder engagement, and integration of implementation evaluation as part of systematic quality work. Moreover, principals are able to allocate resources and prioritize activities, such as dedicating time to mental health topics within teaching schedules, thereby facilitating mHealth adoption among students (Study III). In contrast, Study II found no significant association between leadership engagement and adoption of mHealth in child healthcare. However, this finding should be interpreted with

caution, as the low level of mHealth adoption may have limited the ability to detect statistically significant associations.

The findings also indicate that organizational cultures characterized by psychological safety, respectful relationships, collaboration, and a shared understanding of the health-promoting mission enhanced organizational readiness (Study I), facilitated mHealth adoption among nurses (Study IV), and ultimately supported end-users' mHealth adoption (Study III). Aarons et al.¹⁶⁹ describe how leaders play a central role in fostering a culture supportive of implementation, further confirming the importance of principals and primary care managers for mHealth initiatives. Jakobsson et al.¹⁷⁰ reinforce these findings, showing that a positive work environment with clear goals, well-functioning structures, and interprofessional collaboration is crucial for school nurses' health-promoting work.

The findings can be interpreted through the CFIR framework⁴⁹. Within CFIR⁴⁹, leadership is captured under the inner setting domain as *Leadership Engagement*, highlighting the importance of leaders' commitment to implementation, while this engagement also enables essential implementation activities captured in the process domain, such as *planning* and *engaging key stakeholders*. *Goals and Feedback* reflect the need for clearly communicated implementation goals and continuous feedback, while *Learning Climate* captures an environment where staff feel psychologically safe, recognized, and supported to try new methods. The findings can also be understood through the ORC theory⁶¹. Leadership may strengthen *change commitment* by communicating support for the implementation and linking the change to the organization's overall goals, helping organizational members recognize its value. Leadership further influences *change efficacy* by clarifying what is required for implementation, providing structure and support for the implementation activities involved, and allocating the necessary resources. ORC⁶¹ additionally emphasizes that an organizational culture that fosters innovation and learning serves as a contextual factor influencing organizational readiness.

However, the results also indicate that leadership in child and school healthcare faces challenges. Nurses described high professional autonomy, and several informants reported limited managerial insight or engagement, which hindered change initiatives and implementations (Studies I and IV). Study IV showed that in schools with lower mHealth adoption, managers generally endorsed change initiatives but did not actively engage, leaving nurses responsible for leading and monitoring implementation. This pattern mirrors findings from the implementation of health-promotion programs in Swedish primary schools, where school nurses were similarly perceived to be left to drive

and monitor the process on their own¹⁷¹. Again, this may reflect the structural organization of child and school healthcare and its embedding within schools and primary care, where medical or educational priorities can overshadow the health-promoting mission^{137, 167}. This may also help explain why nurses in larger child healthcare centers reported higher perceived leadership support; such centers more frequently employ managers with clearly defined mandates for child healthcare services, allowing for explicit prioritization of the health-promoting mission (Study II).

While child and school healthcare represent promising settings for public health promotion, they constitute complex and non-linear organizational contexts. Effective leadership in these contexts requires balancing educational and medical mandates with the health-promoting mission, while supporting highly autonomous professional groups. This underscores the need for further knowledge on how leadership in child and school healthcare may be more effectively supported.

A Collective Approach

Although nurses were expected to deliver the mHealth tool individually during health visits, the implementation process had broader implications for routines and ways of working that extended beyond individual nurses and health visits. A collective approach, characterized by professional collaboration both among nurses and between the school healthcare team and teachers, emerged as crucial for establishing new shared routines required for implementation, such as engaging end-users with the mHealth tool outside the health visit (Studies I–IV). These collective processes also enabled peer learning, which in turn strengthened nurses perceived self-efficacy in delivering the mHealth tool during health visits (Studies I and IV).

This collective nature of mHealth implementation aligns with previous research. For example, Osorio et al.¹¹⁶ and Beames et al.⁷⁷, found that collective engagement among staff increased knowledge and self-efficacy, and that collaboration across professional boundaries was essential for successful implementation of digital health interventions in child and school healthcare.

From a theoretical perspective, the collective approach aligns with the assumptions of the ORC theory⁶¹, which conceptualizes readiness as a shared psychological state reflecting members' collective willingness and ability to implement a specific change. In other words, the findings suggest that the role of individual nurses in mHealth implementation should be understood within the context of the team, rather than as isolated characteristics of individual professionals. Collective engagement within the team fosters *change commitment* by creating a shared understanding and motivation for why

implementation is important. It also enhances *change efficacy* by common routines and strengthening individual self-efficacy in using mHealth. These findings are also captured by the CFIR⁴⁹, specifically the Inner Setting construct *Networks and Communication*, which highlights the importance of communication, relationships, and collegial collaboration for successful implementation.

Nevertheless, Study II showed that nurses perceived readiness among colleagues to be low. One possible explanation is the organizational structure of Swedish child healthcare centers, where nurses often work independently with few colleagues in the same profession, potentially limiting opportunities for collective reflection. However, no association was found between the number of nurse colleagues and perceived readiness, suggesting that structural factors alone do not explain the lack of collective engagement (Study II). An alternative explanation is that the implementation strategies employed at the time did not sufficiently address collective and relational aspects of implementation. Study IV supports this interpretation. In schools with low or medium mHealth adoption, implementation activities, were, if conducted at all, limited to nurses. By contrast, the school with high mHealth adoption reported strong interprofessional collaboration and conducted the implementation activities across professional boundaries, including joint planning, collective engagement with the mHealth material, and the development of shared implementation routines. This finding aligns with previous research showing that limited cross-professional collaboration in schools leads school nurses to focus on individual-level interventions¹³⁷, which may be insufficient for successful mHealth implementation.

It is interesting to consider why many child and school healthcare centers did not collectively engage in the implementation process. Indeed, several factors might help explain this. One factor is limited leadership involvement (Studies I and IV). Active and engaged leadership is essential for establishing the collective conditions required for successful implementation, such as fostering a shared understanding, creating forums for dialogue, and organizing structured implementation activities.

A second factor that may explain the limited collective engagement concerns professionals' knowledge and understanding of implementation processes. Child and school healthcare services traditionally focus on supporting and engaging families or students, which means that less attention and emphasis may be given to professionals' own behavioural change processes. Strengthening managers' and professionals' competence in implementation may therefore represent a promising strategy for improving future implementation efforts.

A third factor that may help explain why professionals did not collectively engage in the implementation process relates to perceptions of the mHealth tool itself. The implementation of a mHealth tool may have been seen as a “small change”, relevant only during individual health visits, and therefore not recognized as requiring collective effort. Indeed, Weiner⁶¹ suggests that many evidence-based practices can be adopted independently by professionals with modest training, making collective processes less relevant. However, the findings from the thesis challenge this assumption, showing that implementing mHealth during health visits had consequences beyond the visits themselves, requiring collective efforts to adapt routines, engage end-users, and foster peer learning. From a complexity science perspective¹⁷², healthcare organizations can be understood as complex adaptive systems, composed of multiple interconnected actors with different roles, such as various professional groups and patients. This means that even seemingly small changes in one part of the system may generate additional, unplanned, and often unpredictable consequences in other parts of the system, beyond the primary focus of the intervention. Methodologically, these findings illustrate the importance of understanding how an implementation object interacts with its context over time, using multiple approaches to capture how the implementation may unfold within an organization.

Alignment between mHealth, Organizations, Professionals and End-Users

Across the included studies, alignment emerged as a key determinant for mHealth implementation, referring to the complexity of aligning an innovation with the organization, professionals, and end-users. Overall, a higher degree of alignment was described as facilitating mHealth implementation (Study I, III, IV). In line with Lundmark et al.¹⁷³, who identified two forms of alignment in the implementation science literature, the present findings may be understood along two dimensions: structural and social. Structural alignment concerns the extent to which a mHealth tool fits organizational goals, values, routines, and the needs and preferences of end-users (Study I, III, IV). Social alignment, in contrast, refers to the fit between the innovation and organizational culture within child and school healthcare, as well as nurses’ professional culture, and also encompasses alignment with end users’ life stage (Studies I, III, IV).

Alignment between an innovation and its context is a well-established concept in implementation science, often described through terms such as fit, compatibility, match, or congruence^{173, 174}. In Rogers’ Diffusion of Innovations theory^{46, 47}, compatibility is proposed as a key attribute influencing adoption, referring to alignment with users’ needs, values, and prior experiences. Within

the CFIR framework⁴⁹, *Compatibility* is captured as an inner-setting construct, describing the fit between an intervention and staff norms, values, workflows, and existing systems, while alignment with end-users is reflected in the outer-setting construct *Patient Needs and Resources*. From an ORC theory perspective⁶¹, alignment may reduce the effort required to integrate mHealth into routine practice and thereby strengthen organizational members' *change efficacy*. Similarly, greater alignment between the innovation and organizational goals, values, and culture, as well as with end users' needs, may enhance members' perceptions of the value of the change, which in turn may strengthen organizational members' *change commitment*.

Structural alignment

The findings showed that mHealth content and features that aligned with the goals of child and school healthcare organizations (e.g., health promotion), core values (such as equity and evidence-based practice), and existing workflows increased organizational readiness to implement mHealth (Study I) and facilitated successful implementation (Study IV). In contrast, tools that required registration in external data systems were perceived as misaligned with established routines (Study I). These findings echo previous mHealth research demonstrating that compatibility with existing workflows facilitates adoption, whereas reliance on external systems may hinder implementation^{25, 28, 116}.

Furthermore, alignment with end-users' needs and preferences influenced implementation. Study IV, found that schools with higher adoption served student (i.e., end-user) populations whose needs were better matched by the mHealth tool. Similarly, end-users themselves expressed to be more inclined to adopt the tool when it aligned with their individual needs and preferences (Study III). These findings mirror prior research showing that perceived relevance, usability, and tailored content increase positive attitudes to, and engagement with, mHealth tools among children, adolescents, and parents^{175, 176}. However, Study IV also highlighted the difficulty of anticipating alignment with end-users in advance. Schools with low levels of adoption initially expected the mHealth tool to fit their student population but were later surprised by low engagement. This underscores the importance of pilot testing and ongoing evaluation throughout the implementation process.

Social alignment

Social alignment emerged as equally critical for implementation. This form of alignment reflects how well mHealth tools fit with socially embedded and often implicit norms, values, and assumptions within child and school healthcare. Implementation was facilitated in schools whose organizational culture was

congruent with the innovation (Study IV), whereas the rapidly evolving digital landscape associated with mHealth often conflicted with the slower pace of change typical in child and school healthcare organizations (Study I). Moreover, informants highlighted that, although mHealth tools have the potential to support health promotion practice, they may also clash with professional culture, i.e., the underlying norms and beliefs on how health promotion practice “should” be conducted. Traditionally, this work has centered on relationship- and trust-building with children and adolescents and digital interventions were perceived as potentially undermining these trust-based relationships (Studies I, IV). This concern aligns with previous research which has repeatedly highlighted tensions between mHealth and building relations-building with patients²⁵⁻²⁷. Tensions also arose when nurses, on one hand, promoted app use, while on the other hand, simultaneously advocated for reduced screen time, aligning with earlier findings on misalignment between mHealth and school “no-phone policies”⁷⁷. Nurses with longer work experience expressed lower readiness regarding how mHealth aligned with professional culture (Study II), suggesting that stronger attachment to traditional professional culture may make it more challenging to implement digital innovations.

The social dimension of alignment can also be understood from the perspective of end-users. Study III, exploring high school students’ perceptions of determinants influencing adoption, highlighted that their decision to adopt the app was strongly shaped by the fact that implementation occurred during a formative period in life, when personal preferences and tastes were still developing. This finding suggests that alignment is also influenced by end-users’ current life stage, emphasizing the importance of tailoring strategies to support adoption to the context and life stage of the target population.

Potential strategies to increase alignment

In response to the growing recognition of alignment, co-design approaches (along with related terms, such as co-production and co-creation¹⁷⁷) have received increased attention in mHealth development¹⁷⁸. By actively involving professionals and end-users throughout development, co-design aims to enhance compatibility and increase implementation success^{173, 178}. The findings of this thesis, however, suggest that achieving alignment through co-design may be complex. Even during early development phases, mHealth researchers and developers must balance diverse perspectives from professionals and end-users, address language adaptations, and, as previously discussed, navigate legal and technical requirements needed to implement tools beyond research trials. Furthermore, findings from Study IV revealed that it may be challenging to anticipate all relevant stakeholders who should be included in the mHealth co-

design process. Although the tool was intended primarily for use by nurses during health visits, its implementation had additional, unplanned consequences for other professionals, whose involvement may not always be visible during early phases. Differences in goals and routines across professional groups may necessitate adjustments to content and design to maintain alignment. Therefore, increasing the likelihood of successful implementation may require not only an initial assessment of alignment but also ongoing evaluation and potential realignment¹⁷³. Co-design processes may need to be revisited throughout implementation to ensure continued compatibility with organizations, professionals, and end-users; in other words, the mHealth tool requires a high degree of adaptability.

Although co-design can improve structural alignment, social alignment depends on how mHealth fits into organizational and professional cultures, a challenge that probably cannot be fully addressed through co-design alone. A scoping review by Lundmark et al.¹⁷³ suggests additional strategies, including communication to foster shared understanding of change. Informants consistently emphasized the role of regional governance, through Child Health Councils and central healthcare organizations, in facilitating implementation, noting that these actors strongly influenced nurses' perceptions of legitimate practice (Studies I, IV). Governance and communication from these authorities may have served to confirm that digital tools represent acceptable practices aligned with professional culture. These findings underscore the importance of identifying and involving actors with authority to influence professional culture when implementing interventions that challenge established practices.

In summary, the findings of this thesis indicate that implementation of mHealth interventions is influenced by both structural and social alignment between the innovation and its context, including organizations, professionals, and end-users. Alignment should be viewed as a dynamic process that evolves as change unfolds within the organization, highlighting the need for ongoing evaluation and potentially multiple strategies to support both structural and social alignment.

The Influence of End-Users

Across the studies, end-users, i.e., parents and students, emerged as central agents in the implementation of mHealth, extending beyond passive recipients of the innovation, to actively shaping both the implementation process and outcomes (Study I, III, IV). Within the CFIR framework⁴⁹, their role is primarily captured by the Outer Setting construct *Patient Needs and Resources*, which reflects how end-users' needs are addressed by the innovation and how their feedback influences implementation. Additionally, the Process domain

construct *Innovation Participants* captures efforts aimed at increasing end-user engagement with the innovation.

Study IV, investigating similarities and differences in implementation determinants in schools with different levels of adoption, illustrated how end-users influenced implementation outcomes. Compared to low adoption schools, high- and medium-adoption schools served student populations with more pronounced self-imposed demands, as students were balancing schoolwork alongside part time jobs and spare time activities. In these schools, the mHealth tool aligned closely with students perceived needs and was therefore viewed as a relevant and meaningful resource for communicating the importance of life balance. Furthermore, mHealth implementation was described as a co-implementation between nurses and end-users. When nurses communicated trust in the tool and explained the relevance of the innovation for the specific individual, end-users' were perceived as more inclined to adopt it. In turn, observing positive engagement reinforced nurses' motivation to use and recommend the tool to others (Studies I, III, IV). The ability to observe benefits for end-users is a well-established facilitator in mHealth implementation^{26, 29, 77} and aligns with Rogers' diffusion of innovations theory, where *observability* i.e., the extent to which the results of a new innovation are visible is a key attribute influencing adoption^{46, 47}. Similarly the ORC theory⁶¹ may help explain how observing benefits for end-users can enhance organizational members' perception of the value of the change, thereby strengthening their *change commitment* to take the necessary steps for implementation.

At the same time, previous research has highlighted challenges related to engaging parents and students when implementing digital interventions within school and child healthcare settings^{77, 116}. Study III demonstrated that, students perceived that simply being recommended the app during a health visit was considered insufficient to encourage adoption. Prior research on end-user engagement has often focused on technical aspects, for example ease of use and functionality, and individual factors such as motivation and trust in technology¹¹⁹. The findings from this thesis, however, indicate that end-users' engagement may require broader and more multifaceted strategies, aligned into the life stage of the end-user.

Overall, informants in both child and school healthcare demonstrated an awareness of the importance of engaging end-users. The implementation process was shaped both by end-users themselves and by various efforts to increase their awareness and engagement with the mHealth outside the health visit (Studies I, IV). End-users' prior familiarity with the tool before the visit was perceived to facilitate nurses' delivery of mHealth during health visits, and indeed, attending and adjusting to the needs of parents and students aligns with

the routine working methods of child and school healthcare nurses^{113, 137-139}. A systematic review by Alkhalhadli et al.¹⁰⁷ showed that most strategies used to enhance healthcare professionals' adoption of mHealth target organizational or professional perspectives, such as education, reminders, training, or providing app lists. The findings from this thesis, however, suggest that within school and child healthcare, it is equally important to actively influence end-users' engagement, highlighting that successful implementation may require strategies that address both professional and end-user perspectives. In light of ORC theory⁶¹, awareness of end users' needs may influence staff perceptions of what is required to implement the innovation and whether they have the resources and capacity to do so. For example, recognizing that efforts must occur outside the health visit may influence the perceived task demands for the implementation, which in turn shapes organizational members' *change efficacy* to implement mHealth.

The importance of end-users in implementation is not unique to mHealth. For example, two doctoral theses from Norway and Sweden examining eHealth communication tools and coordinated healthy lifestyle promotion in primary care show that patients actively co-produce implementation, contributing to a shift from provider-centered to patient-centered practice^{179, 180}. Nevertheless, implementation science has traditionally focused on determinants within healthcare organizations^{41, 58, 78}, which may limit our understanding of implementation processes and outcomes. It is possible that the role of end-users in implementations may vary depending on whether the change primarily targets staff or patients/end-users. For example, implementing a medical record system primarily depends on behavioral changes among staff, whereas implementing a health-promoting intervention such as mHealth depends more heavily on patient or end-user behavior. Consequently, assessing the extent to which end-users are central to the change may be essential when determining from which perspective an implementation process should be studied and understood.

Methodological Considerations

This chapter describes and discusses methodological considerations that should be acknowledged when interpreting the findings of this thesis. It begins with an overarching discussion of the methodological choices underpinning the thesis, including the inclusion of diverse mHealth tools and contexts, as well as the implications of adopting a pragmatic approach in real-world implementation settings. The chapter concludes with methodological reflections specific to each research approach.

Reflections on Heterogeneity

To enhance the understanding of the implementation of health-promoting mHealth, this thesis utilized a heterogeneous set of contexts and mHealth tools, both within studies (Study I), and across studies (Study I-IV). Across the included studies, three distinct mHealth tools were examined in two different contexts. This design enabled the identification of similarities and differences across tools and contexts, thereby revealing patterns in the data that might otherwise have been difficult to observe¹⁴⁷.

At the same time, balancing heterogeneity constitutes a methodological challenge. Too much variation across interventions and contexts increases complexity in data, complicates interpretation, may limit the depth of understanding, and can threaten the transferability of findings across contexts. Conversely, too little variation may reduce the ability to identify meaningful differences and commonalities¹⁴⁷.

Child and school healthcare share several characteristics that facilitate meaningful comparisons across contexts. Both operate under an overarching health-promoting mission targeting a young population, and nurses in both contexts conduct health visits in accordance with a national program^{6, 7}. Moreover, nurses in child and school healthcare typically manage their work with a high degree of autonomy and are often positioned at the periphery of larger organizational structures.

Despite these similarities, important differences exist between the two contexts. Child healthcare is embedded within the primary care system and operates under more extensive national guidance⁷, with comparatively standardized working methods⁸. In contrast, school healthcare is a municipal (or independent) responsibility and is characterized by greater flexibility, with working methods to a larger degree adapted to local prerequisites and conditions⁶. The target populations also differ across contexts. Child healthcare

primarily addresses younger children and their parents, whereas school healthcare in this thesis focused on high school students. In this regard, the heterogeneity within the thesis is relatively broad. A potentially more comparable design would have been to include school healthcare targeting younger age groups, such as primary school children, where parents are more actively involved and could be considered part of the target group. However, the inclusion of school healthcare at the high school level was a pragmatic decision based on the availability of mHealth tools suitable for studying implementation. Despite this, the context provided valuable insights into the implementation of mHealth tools.

Furthermore, the three diverse mHealth tools examined in this thesis demonstrated a mix of similarities and differences, rendering them appropriate cases for studying mHealth implementation. All included tools shared a health-promoting purpose, however, they differed in terms of their specific objectives, such as promoting healthy lifestyle behaviours or supporting mental health, and in how they were applied in clinical practice. More specifically, the implementation of each tool required different types of behavioural change on the part of nurses, depending on the tool's design and intended use. Life4YOUth³⁰ required nurses to integrate discussions about the app into the existing structure of the health visit, recommend its use, and potentially guide end-users in how to access and navigate the app. MINISTOP^{31, 32} similarly required integration into the health visit, but additionally involved an extra step in which nurses registered parents in a separate caregiver interface. The DSI tool³³ comprised both an app and paper-based material designed to support nurses in communicating about mental health as well as about the app itself. Consequently, the behavioural changes required for implementing DSI³³ involved initiating conversations about mental health using paper-based materials and recommending the app to students. Additional heterogeneity among the mHealth tools could have been achieved by including interventions that, for example, required nurses to monitor or follow up on health data, or to communicate with end-users between visits. However, such features are less common in health-promoting mHealth interventions and were therefore considered less relevant to the overall aim of this thesis.

A key foundation of this thesis was the inclusion of both child and school healthcare contexts, as well as two mHealth tools, within Study I. This design not only deepened the understanding of organizational readiness for mHealth implementation but also served as a basis for identifying and interpreting patterns across contexts and tools in the subsequent studies. Although the later studies focused on individual contexts and interventions, their findings could be interpreted in light of the broader insights generated in Study I. Moreover, the

study gave support to the transferability of findings across child and school healthcare contexts.

In summary, synthesizing findings from four studies spanning two contexts and three interventions provided a richer and more nuanced understanding of the implementation of health-promoting mHealth tools in child and school healthcare. This diversity also strengthened the transferability of the thesis's findings to other contexts and interventions¹⁴⁴.

Nevertheless, the broad scope of the thesis meant that some aspects could not be examined in depth that would otherwise have been desirable. First, the outcome evaluations were limited to implementation outcomes at the professional level (Study II) and the organizational level (Study IV). Although Study III captured students' perceptions of determinants for mHealth adoption, clinical outcomes related to children, parents, or students were not assessed due to time and feasibility constraints within the scope of the PhD project. For the same reasons, service outcomes, such as equity and accessibility to child and school healthcare services, were not evaluated.

Second, the studies conducted during the implementation phase (Studies III and IV) focused exclusively on the school context. While the main findings were largely consistent across the studies in the preparation phase (Studies I and II) and the implementation phase, suggesting transferability between child and school healthcare services, this conclusion is not grounded in empirical implementation-phase data from child healthcare. Finally, the end-user perspective was limited to high school students. Parents, as end-users, may require different strategies to support the adoption of mobile health tools, which could influence the implementation process.

Reflections on the Pragmatic Approach

Studying real-world contexts is essential for understanding how innovations are implemented and integrated into routine practice. However, research conducted under real-world conditions entails limited control over factors that may influence implementation processes. Consequently, such research requires a pragmatic approach that balances methodological rigor with clinical feasibility. While a pragmatic approach increases external validity, it often limits the internal validity.

One illustration of the methodological consequences of adopting a pragmatic approach can be seen in Study II, which aimed to assess organizational readiness for mHealth implementation and examine its association with adoption. The study was embedded within the implementation of MINISTOP³², which was introduced across all 77 child health centers within

a single healthcare company. Child healthcare nurses at the centers completed an organizational readiness questionnaire at the start of implementation. To accommodate clinical conditions, however, each child healthcare center was given flexibility to determine when to initiate implementation by selecting one of six starting points. This flexibility may have resulted in centers initiating implementation when they perceived themselves to be most prepared, thereby potentially reducing variability in readiness and adoption data.

A further example is found in Study IV, which investigated determinants for implementing a mental health mobile-based intervention (the DSI³³), within school healthcare. DSI³³ comprised two components: an app for students and a paper-based tool for school nurses. Initially, the study intended to focus solely on the app-based component. However, school nurses perceived DSI as an integrated package, making it difficult to separate the components and their respective implementation determinants. A pragmatic decision was therefore made to treat the intervention as comprising both components. Indeed, this dual structure reflects the complexity often inherent in mHealth interventions, where digital and analog elements often are combined¹⁸¹. At the same time, this approach entails a risk that the determinants and implementation outcomes captured in Study IV may have been more strongly associated with one component than the other.

Research conducted under real-world clinical conditions benefits from outcome measures that minimize the burden for clinical staff³⁶. A strength of this thesis is that implementation outcomes in Studies II and IV were assessed using adoption measures closely aligned with routine practice, specifically via the MINISTOP interface (Study II) and via documentation in students' charts (Study IV). This alignment with routine practice strengthens the internal validity of the studies.

Methodological Reflections on Qualitative Studies

In qualitative research, trustworthiness is a central concept used to assess study quality and concerns whether the findings are “worth paying attention to”¹⁸². Lincoln and Guba¹⁸² propose four main criteria for establishing trustworthiness: credibility, dependability, transferability, and confirmability, which should be considered throughout the research process¹⁸³. Additionally, reflexivity is recognized as an important component of qualitative research quality¹⁴⁷. Below, methodological considerations of the three qualitative studies (Study I, III, IV) are discussed in relation to these criteria.

Credibility

Credibility refers to whether the study findings represent a credible interpretation of informants' original data and adequately reflect the phenomenon under investigation^{144, 184}. Credibility is influenced both by how the study is conducted and by how the research process and findings are reported¹⁴⁴.

The choice of data collection method is central to establishing credibility¹⁸⁵. All qualitative studies in this thesis employed individual interviews, chosen to facilitate exploration of participants' experiences and to allow participants to speak freely without feeling inhibited by others. Individual interviews also enabled the inclusion of participants from a wide range of organizational contexts, such as schools and child healthcare centers of varying sizes, profiles, and organizational cultures.

Many interviews, particularly those with professionals (Study I, IV), were conducted digitally. In Study I, this format was necessitated by pandemic-related restrictions, whereas participants in subsequent studies were offered a choice between in-person and digital interviews. Previous research indicates that digital interviews entail both advantages and limitations: they may make it more difficult to interpret non-verbal cues and involve technological challenges, but they also enable broader geographic recruitment and may promote openness when discussing sensitive topics¹⁸⁶. Based on our experience, the digital interviews often yielded rich data and made it easier to schedule interviews at times convenient for the participants. However, research on digital interviews with adolescents remains limited, and there is insufficient evidence regarding whether digital and in-person interviews are equivalent in terms of data quality¹⁸⁶. Importantly, most interviews with high school students in Study III were conducted in person, thereby reducing the risk that data quality was negatively affected by the interview format.

All interviews were based on semi-structured guides inspired or guided by theory^{44, 49, 61}, ensuring that relevant topics were addressed during the interviews. The guides were pilot-tested to confirm that they adequately covered the research question¹⁸⁴ and that the questions were asked in an appropriate manner to obtaining rich data¹⁸³. The scope of the interview guides varied across studies in relation to their aims and analytical approaches. Studies I and III employed relatively concise guides (approximately ten questions), allowing for further exploration through follow-up questions and probing. In contrast, Study IV utilized a comprehensive interview guide structured around the constructs of the CFIR⁴⁹, enabling systematic data collection, deductive coding, and cross-school comparisons. While this approach supported a broad overview of

implementation determinants, it limited opportunities for in-depth exploration of individual constructs due to time constraints.

Credibility further depends on the inclusion of participants with relevant knowledge and experience of the phenomenon under study^{147, 183, 184}. Given that health-promoting mHealth use is relatively uncommon among child and school healthcare professionals and students, a key strength across all the qualitative studies, was that participants had prior experience with mHealth.

Credibility was further supported by including participants with diverse backgrounds and experiences, enabling the research questions to be examined from multiple perspectives¹⁴⁷. Across the thesis, three mHealth tools were studied within two contexts, and participants represented organizations varying in size, educational profiles, socioeconomic settings, geographical locations, and organizational levels. In Study III, which explored students' perceptions of determinants for adopting a mental health app, additional heterogeneity arose from variation in the time elapsed between the health visit at which the app was recommended and the interview. While longer intervals may have introduced recall bias¹⁸⁷, they may also have provided opportunities to reflect on factors influencing adoption. Including both early and later interviews thus provided complementary perspectives.

Gender representation also has implications for credibility, as experiences and interpretations of the studied phenomena may differ by gender. In Studies I and IV, all participating child and school healthcare nurses were women, reflecting the gender distribution of these professions in Sweden. Policymakers included in Study I were exclusively male. The inclusion of female policymakers might have added further perspectives on organizational readiness. In Study III, students' perspectives were obtained solely from female participants, despite repeated efforts to recruit male students. This limits the transferability of findings related to mHealth adoption among male students.

Credibility is influenced by the adequacy of the sample size^{184, 185}. There is no universal standard for sample size in qualitative research, as it depends on both the study's aim and the richness of the data¹⁸³. Data saturation is one commonly used indicator^{144, 183, 188}, while the concept of information power provides additional guidance¹⁸⁹. Study I had a broad aim and a heterogeneous sample, necessitating a larger number of interviews. Study III had a narrower aim and a more homogeneous sample, allowing saturation to be reached with fewer interviews. Study IV employed a cross-case design in which two to four nurses and principals represented each school. As described by Malterud et al.¹⁸⁹, the objective in such designs is not necessarily saturation within each case but to collect rich and varied data to support cross-case comparisons. Guided by

the principle of information power, the sample size in Study IV can therefore be considered adequate.

Finally, credibility was strengthened through investigator triangulation^{144, 182}. Iterative discussions among the researchers regarding coding, analysis, and interpretation reduced the risk of the data being understood from a single researcher's perspective. These collaborative reflections enabled the consideration of multiple interpretations, resulting in a more nuanced and well-grounded understanding of the data. These reflections were supported by the research team's diverse competencies and backgrounds, which enabled multiple interpretations and enriched the understanding of the data.

Transferability

Transferability refers to the extent to which study findings may be applicable to other contexts^{182, 184}. The heterogeneity of the thesis constitutes a methodological strength, as variation across contexts, interventions, and participants enhances the potential for transferability. This is further supported by the provision of detailed descriptions of contexts and participant characteristics, enabling readers to assess the relevance of the findings to their own settings¹⁸⁴. Moreover, the explicit use of theory facilitates comparability across contexts and supports transferability⁴².

Dependability

Dependability refers to the stability of data over time and the consistency of the research process¹⁸². Dependability was supported during data collection through the use of interview guides and continuous dialogue among interviewers to ensure a consistent approach. Analyses were conducted in accordance with the respective analytic methods and included investigator triangulation, with iterative discussions among researchers regarding coding, categorization, and interpretation¹⁸⁴. In addition, field notes and analytic memos were maintained to document decisions, changes, and emerging interpretations throughout the research process. Finally, detailed reporting of the study process strengthened dependability.

Confirmability

Confirmability refers to the extent to which findings can be confirmed by other researchers, ensuring that results are grounded in data rather than shaped by the researcher's interpretations¹⁸². Confirmability was supported through researcher discussions and transparent reporting of the research process and

findings. The use of participant quotes further illustrated how the findings were rooted in the data¹⁸³.

Reflexivity

Reflexivity is an important aspect of quality in qualitative research and concerns the researcher's awareness of how her own background, assumptions, and positionality may influence all phases of the research process¹⁴⁷. Reflexivity was addressed throughout the research process in several ways. All studies began with the PhD student writing a pre-understanding statement, in which prior knowledge, experiences, and assumptions about the research topic and anticipated findings were documented. Continuous discussions within the research team took place throughout the studies to enhance reflexive awareness and to critically examine potential influences on the findings.

Methodological Reflections on Quantitative Study

Study II was designed as a prospective observational study to assess organizational readiness prior to implementation of mHealth (MINISTOP³²) and to explore associations between organizational readiness and mHealth adoption. As an observational study, it does not establish causality, and the findings may be influenced by bias and unmeasured confounding factors¹⁹⁰. The choice of design was pragmatic, as the aim was to investigate the implementation of MINISTOP³² under real-world conditions. The methodological quality of observational studies is commonly discussed in terms of internal and external validity¹⁹⁰. Accordingly, methodological considerations related to Study II are discussed below in relation to these concepts.

Internal Validity

Internal validity refers to the extent to which a study accurately measures what it intends to measure and the degree to which findings might be influenced by bias and confounding factors¹⁹⁰.

One aspect of internal validity in Study II concerns the measurement of organizational readiness and adoption. Organizational readiness was assessed using the E-Ready questionnaire¹²¹. Although alternative instruments were available, several had demonstrated limited reliability and validity¹⁹¹ and many readiness questionnaires are generic, comprehensive, and often perceived as difficult to interpret by clinicians¹²¹. E-Ready¹²¹ was selected because it addressed several of these limitations: it was developed and psychometrically evaluated within the Swedish healthcare system, specifically targeting readiness for digital interventions, and designed to be easy to complete¹²¹. The

questionnaire has been used in both international¹⁹² and national¹⁹³ digital health research.

At the time Study II started, E-Ready¹²¹ was a relatively new instrument and had not been applied beyond its initial development. Therefore, additional psychometric analyses were conducted within Study II using Rasch analysis. This enabled a more detailed examination of how individual items captured the latent construct of readiness, identified items that did not perform as expected, and improved overall measurement precision. Based on model fit, the Rasch analysis allowed for the transformation of ordinal raw scores into interval measures, resulting in a more precise measurement. However, the Rasch analysis also revealed limitations within the questionnaire. Reliability varied across dimensions, ranging from low (dimensions 2 and 6), to acceptable for group-level measurement (dimensions 1 and 5), and good for individual-level measurement (dimensions 3 and 4). As analyses in Study II were conducted at the individual level, findings related to dimensions 1 and 5, and particularly dimensions 2 and 6, should therefore be interpreted with caution.

A strength of Study II is the use of an objective measure of adoption derived from the MINISTOP³² child healthcare interface. This constitutes an advantage compared with many studies examining associations between organizational readiness and implementation outcomes^{67, 194, 195}, which rely on self-reported measures. However, this measure does not capture instances in which parents declined the app, nor does it reflect nuances of nurses' adoption behaviours, such as whether the app was merely mentioned or whether nurses actively engaged parents by explaining its content and demonstrating its use.

A limitation of Study II was the low level of adoption, which reduced the ability to detect significant associations between readiness and adoption. This may reflect that adoption was assessed at an early stage of the implementation process, when nurses had not yet begun to actively use the tool. However, assessment at a later stage was not feasible due to synchronization with parallel studies³². Conversely, long intervals between the assessment of readiness and adoption may introduce temporal bias, whereby the timing of measurements influences the observed associations¹⁹⁵. As readiness is a dynamic construct that may change throughout the implementation process⁶⁵, it may need to be assessed close in time to adoption. Future research would benefit from longitudinal designs that follow both readiness and adoption over time.

External Validity

External validity refers to the extent to which study findings can be generalized to settings or populations beyond the specific study context¹⁹⁰.

A strength of Study II is the inclusion of a wide range of child healthcare centers, which contributed data from diverse organizational settings. This variation enhances the representativeness of the findings across different types of child healthcare centers. However, all participating centers belonged to a single healthcare organization. External validity would therefore have been strengthened by including centers from additional organizations, such as regional providers or other private actors.

Another strength relates to the inclusive recruitment strategy, whereby all nurses at participating centers were invited to take part. This approach supports the representativeness of the child healthcare nurse population. Nevertheless, there remains a risk of selection bias. Nurses who chose to participate may differ from non-participants, for example by holding particularly positive or particularly critical views regarding mHealth readiness. In addition, Study II was conducted during the first year of the real-world implementation of MINISTOP, although implementation continued beyond this period. Since the centers themselves decided when to initiate the implementation, there is a risk that those starting in the first year were more ready than those who began later. Furthermore, centers could choose among six start waves during the first year, which likely resulted in implementation commencing when units perceived themselves as most prepared.

All participants in Study II were women, reflecting the composition of the target population ($n = 135$). As previously discussed, this can be considered representative of child healthcare nurses in Sweden. However, this limits the generalizability of the findings to healthcare settings with greater gender diversity.

The response rate for the questionnaire was 66%. This is somewhat lower than rates reported in previous questionnaire-based studies within Swedish child healthcare, which have ranged from 72%¹⁹⁶ to 85%¹⁹⁷. The reasons for this difference remain unclear. Due to the lack of individual-level data for non-responding nurses, such as age or professional experience, it was not possible to conduct a detailed analysis of potential differences between responders and non-responders. However, analyses at the center level showed no significant differences in center size between responding and non-responding nurses.

Low response rates among nurses are a well-documented challenge in survey-based research. Timmons et al.¹⁹⁸ report that the average response rate is around 60%, but it can be as low as 15 %. Common barriers include limited time, high workload, restricted contact with researchers, lengthy or complex questionnaires, and general survey fatigue¹⁹⁸. These findings highlight the responsibility of the research community to design user-friendly questionnaires,

carefully plan survey administration and maintain visibility and engagement within healthcare settings to support participation¹⁹⁸.

Theoretical Reflections

The Theory of Organizational Readiness for Change

Weiner's theory of organizational readiness for change (ORC)⁶¹ served as the theoretical foundation in both Study I and II. The ORC⁶¹ was also applied in the cover story to interpret and explain the main findings of the thesis.

The theory conceptualizes readiness as a shared psychological state reflecting members' collective willingness and ability to implement a specific change. Indeed, the main findings of this thesis highlight the collective processes in mHealth implementation, reinforcing the theory's core assumptions.

Findings from Study I may partly be explained by the ORC⁶¹. Using a qualitative inductive approach, the study identified one main category: *trusting conditions for implementation of mHealth*. This category can be interpreted as an expression of the collective psychological construct, i.e., organizational readiness to implement mHealth, while the four categories reflect contextual factors influencing the ORC dimensions *change commitment* and *change efficacy*. For example, perceived governance influenced members' perception of the change as important and legitimate, which in turn shaped their change commitment, whereas the existing data management infrastructure shaped members' change efficacy regarding the organization's capacity to store health-data. However, Study I also revealed that ORC⁶¹ does not fully capture nuances of mHealth readiness. Findings suggest that some aspects of readiness are more critical than others. For example, when organizations lacked capability to manage health-related data produced by mHealth or governance of the implementation, readiness was perceived as low even when other aspects of readiness were high. ORC theory⁶¹ conceptualizes readiness as a homogeneous phenomenon, making it less effective in capturing these nuances.

Study II highlighted methodological challenges in measuring organizational readiness as a *collective* psychological construct using questionnaires. Previous research has shown that many instruments have limitations in their psychometric properties^{66, 191, 199}. One of the most promising instruments, the Original Readiness for Implementing Change (ORIC)²⁰⁰, is based on ORC⁶¹. Therefore, ORIC was translated and pilot-tested within the scope of this PhD project. However, the pilot-testing revealed that respondents

found it difficult to answer, partly due to “we-form” phrasing and partly because of theoretical, generic questions that lacked practical relevance. Consequently, a decision was made to instead use the E-Ready questionnaire¹²¹. This questionnaire assesses readiness at both individual and collective levels and was developed with practical relevance and usability in mind. However, E-Ready does not capture ORC’s core collective psychological construct; rather, it measures determinants of readiness, and is based on multiple frameworks, including, for example, ORC⁶¹, determinants of implementation^{47, 49} and individual behavior change²⁰¹. Therefore, findings from Study II cannot be considered a direct measure of organizational readiness as defined by Weiner’s theory⁶¹, but rather antecedents of the collective, shared, phenomenon. This contrasts with Wiener⁶¹, who emphasize that ORC instruments should capture the facets, change commitment and change efficacy, not their antecedent conditions. This choice, however, was necessary: if an instrument cannot be meaningfully answered in practice, measurement becomes neither useful nor valid²⁰².

Experiences from Study II also highlight challenges in applying the theory at the appropriate level of analysis in certain contexts. The large implementation of MINISTOP³² was initially thought to provide favourable conditions for examining associations between organizational readiness and implementation outcomes, as multiple child healthcare centers implemented the same innovation during a short time period⁶⁰. However, the child healthcare context revealed difficulties in applying the level of analysis as recommended by ORC theory⁶¹. According to the ORC⁶¹, organizational readiness should be understood as a collective phenomenon and analysed at the organizational level. In child healthcare, many centers consisted of only one or a few nurses, making analyses at organizational level methodologically problematic. Consequently, analyses were conducted at the individual level, with the assumption that collective processes still shape individual perceptions of readiness and subsequent adoption behaviors. Previous literature often addresses this challenge by collecting data from one or a few representatives per unit^{60, 67, 194, 195}, which, on the other hand, risks reducing a collective phenomenon to a single individual’s perception. Together, these difficulties illustrate broader methodological challenges in quantitatively assessing organizational readiness and selecting an analysis level that is both theoretically sound and practically feasible.

Findings from Study I demonstrated that dealbreakers for organizational readiness are associated with the outer context, such as regulatory requirements and national governance. Organizational readiness, however, is typically conceptualized as an inner-context construct. These findings make an important contribution, by highlighting the need to consider the factors beyond the inner

context, particularly for innovations that are largely influenced by external conditions. Importantly, aspects of outer context would not have been captured if organizational readiness had solely been assessed through questionnaires, such as E-Ready¹²¹, as these primarily focus on inner-context factors⁶². This underscores the value of combining methodological approaches to fully capture organizational readiness.

Finally, the ORC⁶¹, in its collective psychological state, as defined by Weiner's theory, may provide valuable theoretical insights into how and why an implementation succeeds. However, the theory may be less suitable for providing insights into practical implementation. For practical purposes, such as identifying improvement areas or mapping barriers and facilitators prior to implementation, organizational readiness concepts that do not focus on the shared psychological construct, or alternative determinant frameworks may be more relevant and useful.

The Consolidated Framework for Implementation Research

CFIR⁴⁹ was used as the theoretical framework in Study IV and subsequently applied in the cover story to synthesize findings across the four studies and guide the interpretation of the thesis's overall results.

A key strength of CFIR⁴⁹ is its comprehensive scope, which enables the identification of determinants operating at multiple levels. This breadth proved valuable in Study IV, where the framework supported the identification of a wide range of relevant determinants to mHealth implementation. CFIR⁴⁹ also contributed to enhancing the understanding of the thesis's main findings in the cover story. Specifically, as a determinant framework, CFIR⁴⁹ was useful for identifying *which* factors that influenced implementation, thereby complementing ORC⁶¹, which, as a theory, helped explain *how* these factors influenced the implementation.

However, applying CFIR⁴⁹ to the thesis's main findings also revealed certain limitations. Notably, the framework lacks a construct that explicitly captures organizational capacity for data management; an issue that emerged as a critical dealbreaker for mHealth implementation (Study I). This limitation has likewise been highlighted in previous research on mHealth implementation¹⁰⁶. Additionally, CFIR's⁴⁹ breadth may come at the expense of depth. The extensive number of constructs can make it challenging to achieve a deeper understanding of individual constructs, and there is a risk of becoming lost in details, thereby missing the overall picture of what truly matters¹⁷⁹.

Previous research has highlighted challenges in clearly distinguishing the inner- from the outer setting⁵⁰. This issue became particularly evident in Study IV, where a consistent operationalization of inner and outer setting needed to be developed across five different schools to enable comparisons. The study revealed that school nurses operate within multiple inner settings, which vary depending on structural and organizational conditions. To ensure comparability between schools, we therefore defined the school as the inner context. This required thorough knowledge and understanding of the conditions at all five schools before arriving at a definition applicable in each case. The challenge of managing several overlapping inner settings is likely relevant for other organizations operating within complex structures.

We made large use of the CFIR's coding manual¹²⁷ during the deductive coding process, together with operationalization of the constructs and a consensus-based approach. Some constructs were relatively straightforward to code, such as *Structural Characteristics* and *Leadership Engagement*. Others were more abstract and required further operationalization as the study progressed. Constructs within the *Process* domain, in particular, demanded additional refinement. For example, CFIR⁴⁹ assumes clearly defined roles in the implementation process, such as *Champions* or *Formally Appointed Implementation Leaders*. While this facilitates comparability across studies, such roles can be challenging to operationalize in a way that is both relevant and consistent across multiple contexts, particularly in implementations that are less formal, smaller in scale, and highly adapted to local contexts. Consequently, the operationalization of constructs within the *Process* domain became an iterative endeavor rather than something that could be established in advance. This required many discussions among researchers and revisions of both coding and operationalizations. Furthermore, CFIR⁴⁹ adopts a somewhat institutional perspective, focusing on staff adoption of a new intervention. End-users, by contrast, are positioned in the outer context, placing them somewhat on the periphery of the implementation process. However, Study IV showed that the process in fact was centered around the end-users (i.e., students). CFIR⁴⁹ may therefore seem more intuitive in implementations primarily targeting staff, such as when implementing a health record system. Although the updated version of CFIR⁵⁰ places greater focus on end-users, studies on mHealth implementation continue to report that the end-user perspective is not fully captured by the framework¹²⁴.

Reflections on the Evaluation Approach

The CFIR evaluation approach¹²⁶ further strengthened the analysis in study IV by helping to identify constructs of particular importance for higher

implementation outcomes. This approach facilitates comparisons with other studies using the same methodology, contributing to enhanced knowledge of which constructs that appear influential across contexts and interventions. Indeed, this addresses an important need within implementation science to compare determinants across different interventions and settings⁵⁸.

However, there are also potential flaws associated with this approach, some of which relate to preconceptions shaped by different research traditions. A methodological aspect particularly worth reflecting on is the use of a -2 to +2 scale to rate each construct's influence on implementation. These ratings are not statistical findings; they instead serve as an analytical tool for interpreting qualitative patterns across units. Nevertheless, this approach carries a risk of misinterpretation due to the traditional divide between qualitative (text-based) and quantitative (numerical) methods¹⁴⁴. Presenting determinants in numeric, tabular form may suggest quantitative precision, despite the intent being purely descriptive and aimed at systematically representing qualitative findings. Furthermore, the ratings may gloss over nuances in the qualitative data that provide a deeper understanding of the implementation process¹²⁵.

Furthermore, while CFIR⁴⁹ as a determinant framework, provides descriptive insights into which determinants influence implementation, it does not explain how the determinants interact with one another. To address this limitation, Study IV applied the deductive analytic approach as described by Gale et al.¹⁵⁴. Through the use of analytic memos and research team discussions, this approach enabled the identification of relationships between CFIR constructs and supported a more interpretive understanding of their interconnections. For example, the analyses revealed how the construct "*Goals and Feedback*" was linked to "*Leadership Engagement*", which in turn helped identify which constructs that functioned as the "prime drivers" distinguishing schools with varying levels of adoption.

Conclusions

The overall aim of this thesis was to generate knowledge about the implementation of mHealth interventions that support health promotion practices during routine health visits in Swedish child and school healthcare. The synthesized findings from the four included studies support several conclusions:

- The implementation of mHealth is a complex and dynamic process influenced by contextual factors operating at multiple levels, within both the inner and outer contexts of child and school healthcare organizations. While some of these factors appear to be influential throughout both preparation and implementation phases, others are particularly critical during the preparation phase, when decisions about whether and how to implement mHealth are made.
- Organizational readiness to implement mHealth can be understood as the presence of trusting conditions for implementation. The capability of organizations to securely manage the health-related data generated by mHealth tools, as well as the presence of clear governance for implementation, are perceived as critical prerequisites for readiness. When these conditions are lacking, child and school healthcare organizations describe a limited readiness to implement mHealth. Child healthcare nurses report varying degrees of readiness across different organizational readiness dimensions. The findings do not provide evidence of an association between organizational readiness and implementation outcomes; however, they indicate a trend suggesting that collegial readiness may be related to higher levels of implementation outcomes.
- Governance across both the inner and outer contexts emerges as a crucial factor for the implementation of mHealth in child and school healthcare. Governance structures are strongly shaped by the complexity of these services and by their embeddedness within larger systems of primary care and education, where health-promoting objectives must be balanced against broader medical and educational priorities. Implementation is facilitated by governance at multiple levels: nationally; through regional organizations providing profession-

specific guidance for nurses; and by immediate managers (such as principals or primary care managers).

- Implementation of mHealth during health visits has implications for routines and ways of working that extend beyond individual nurses and health visits. The implementation process is characterized by a collective approach, involving both nurses and other professional groups in carrying out activities associated with implementation. Nurses' learning and engagement with mHealth are strengthened through peer-learning, which increases their self-efficacy in delivering the intervention to end-users. This collective process is facilitated by strong and trusting professional relationships, camaraderie, and a shared understanding of the health promotion mission.
- mHealth implementation is characterized by a complex social and structural alignment between the mHealth intervention and the organizations, professionals, and end-users involved. Specifically, a high degree of alignment between the design and content of the mHealth intervention and the overarching goals, clinical routines, and values of child and school healthcare, along with compatibility with end-users' specific needs and preferences, appears to facilitate implementation. Implementation is also influenced by how well mHealth aligns with prevailing organizational and professional cultures, as well as with the life stage of the end-users.
- End-users emerge as central agents in the implementation of mHealth, influencing both the implementation process and its outcomes. Adoption of mHealth by end-users appears to require multifaceted strategies to raise awareness beyond individual health visits, tailored to the end-users' life stage. During individual health visits, the implementation of mHealth can be understood as a co-implementation process between end-users and nurses, in which their behaviours reciprocally shape one another.

Implications

Implications for Practice

The implications for practice from the thesis can be considered across multiple levels: **national, regional, local** (child and school healthcare organizations), the **individual health-visit with the end-user**, and in relation to the **development of mHealth interventions**.

First, this thesis highlights dealbreakers for organizational readiness, particularly relevant at the **national level**. The findings indicate that informants perceived low readiness regarding the capacity to manage health-related data generated by mHealth. This suggests that national action is needed to support interoperability and strengthen the capacity within existing data management systems. Furthermore, current regulations governing mHealth were described as difficult to interpret and apply in practice, which could lead decision-makers to refrain from implementation. There is therefore a need to clarify the regulations and standards governing mHealth tools. Moreover, despite extensive national digital policy ambitions over the past decade, informants perceived low national governance of mHealth, expressing uncertainty regarding its role in healthcare practice and whether it should be prioritized. Efforts are needed to bridge the gap between national policies and the governance experienced in clinical practice. Professionals also reported receiving limited support in identifying appropriate mHealth tools and perceived to be left alone to draw their own conclusions regarding evidence and data security. A national incentive, such as an “app-library” for mHealth tools based on established standards, could support organizations in navigating the large number of available tools and, in the long run, help accustom healthcare organizations to a digital working culture.

At the **regional level**, the findings underscore the importance of governance from child health services councils and central school health organizations in authorizing mHealth tools and coordinating implementation across regions or municipalities. Involving these actors in the implementation could therefore facilitate its process and increase the likelihood of success.

At the **local organizational level**, leadership within child and school health services proved critical. Nurses described how their health-promotion responsibilities were often overshadowed by the broader tasks of the primary care center or school. Organizations in which managers demonstrated active

engagement in both mHealth implementation, and the overarching health-promotion mission achieved better implementation outcomes. Consequently, managers need to actively prioritize health promotion, plan implementation, communicate its goals, create forums for stakeholder engagement, and systematically monitor and evaluate implementation progress.

A careful needs assessment is also essential when selecting which mHealth tool to implement, as higher adoption was observed in schools where students' needs were more closely aligned with the intervention. At the same time, the difficulty of predicting such alignment in advance underscores the importance of pilot testing and ongoing evaluation throughout the implementation process.

The findings further emphasize the importance of positioning end-users as active agents in the implementation process, rather than passive recipients of the mHealth tool. End-users expressed that a mere recommendation was insufficient to encourage adoption. Engagement strategies that extend beyond the health visit and are tailored to the end-user's life stage are therefore needed to raise awareness and motivate use. Since mHealth implementation was described as a co-implementation between professionals and end-users, strategies targeting end-users should be regarded as part of implementation strategies aimed at professionals.

mHealth implementation emerged as a collective endeavor among professionals. Implementation strategies should therefore include components that foster collaboration, relationship-building, shared learning, and opportunities to develop shared routines among staff, ideally across professional boundaries. Additionally, clearly communicating how data is securely stored is essential, as trust in data security strongly influences professionals' willingness to adopt mHealth.

At the **level of the health visit**, end-users' adoption can be supported by personalising the visit, explaining how the app relates to individual end-user needs, demonstrating and navigating the app, and communicating trust in the tool. The findings also showed that professionals often learned alongside end-users during these visits. This underscores the importance of fostering an open and supportive climate and actively inviting feedback during visits, as limited feedback was reported to reduce nurses' willingness to continue offering the app.

Finally, the findings suggest clinical implications for **mHealth development**. The results underscore the need to align mHealth tools with organizations' overarching goals, clinical routines, organizational values and end-users' needs and preferences already in the design phase. Furthermore,

data management considerations should be integrated early in the development process, including planning for how data will be handled beyond the research trial. The findings also indicate that co-design processes may need to be revisited throughout the implementation period to maintain alignment, as mHealth tools can affect routines and workflows of additional professional groups whose involvement may not be apparent during the early stages of intervention development.

Implications for Research and Future Directions

Previous research on mHealth implementation has primarily focused on mHealth tools targeting adults with chronic conditions in hospital and primary care settings, often emphasizing individual adopter perspectives and technological factors²⁵⁻²⁹. This thesis advances the field by offering new insights into the implementation of health-promoting mHealth in child and school healthcare, highlighting multi-level contextual factors that shape implementation. These findings provide a foundation for developing and evaluating implementation strategies specifically tailored to these contexts in future research.

Much of the existing research on mHealth implementation has focused on the implementation phase itself^{25-29, 77, 116}. This thesis identifies organizational “dealbreakers” arising during the preparation phase. Future research should extend this work by examining implementation in later phases, to advance understanding of how mHealth interventions are sustained over time. Studies evaluating service and clinical outcomes under real-world conditions are also needed to establish the broader impact of health-promoting mHealth tools for children and adolescents. Importantly, the findings indicate that higher adoption occurred in schools where student needs were better aligned with the existing tool, specifically in theoretical programs, which suggests a risk of inequitable reach. Future research should therefore investigate which end-users are reached by mHealth in practice to ensure that mHealth does not exacerbate existing health inequalities.

This thesis deepens understanding of governance and leadership within the complex and non-linear organizational structures of child and school healthcare. The findings underscore the importance of inner-setting leadership, however, yet also indicate that immediate managers face challenges balancing the specific mission of child and school healthcare with broader educational and healthcare goals, while leading highly autonomous professionals who are also

governed at the regional level. Future research should explore how leaders understand and enact their roles and how leadership can be supported to facilitate implementation. The limited attention given to professionals' own behavioral change processes in mHealth implementation points to gaps in implementation knowledge and competence. Research should therefore investigate whether strengthening implementation capacity among managers and staff can improve the effectiveness of future implementation efforts.

The findings further show that mHealth implementation affects not only nurses and end-users but also routines and work practices among other professional groups. Future studies should include broader professional perspectives to better understand contextual conditions influencing mHealth implementation in these contexts.

End-users have traditionally received limited attention within implementation science^{41, 58, 78}. This thesis demonstrates that end-users, here students, are active agents shaping both the implementation process and its outcomes. The degree of end-user involvement is likely to vary depending on the intervention's primary target group, whether staff or parents/students/patients. Future research should therefore clarify how end-users influence implementation across different intervention types and contexts and identify conditions under which their perspectives are particularly critical. Furthermore, prior research has emphasized challenges in engaging parents and students when implementing digital interventions within school and child healthcare settings^{77, 116}, however, studies on engagement have largely focused on technological features and individual attributes¹¹⁹. Findings from this thesis show that engaging high-school students requires strategies aligned with their life stage. Future research should therefore investigate determinants of engagement across different end-user groups from a broader contextual perspective.

Finally, this thesis contributes specific knowledge on organizational readiness for implementing health-promoting mHealth within child and school healthcare. Future research should address the conceptual ambiguity surrounding readiness and develop theory-driven and practically applicable measurement instruments. Longitudinal studies are particularly needed to examine how organizational readiness relates to implementation outcomes over time.

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Appendix I

Interview guide, Study I

Nurses

1. Can you tell me about your professional role and work?
2. How does your organization currently work with mHealth?
3. How do you perceive the need for mHealth in child/school healthcare?
4. What has motivated you and your colleagues to participate in the Life4YOUth/MINISTOP trials?
5. How have you and your colleagues proceeded to use the Life4YOUth/MINISTOP tools in your daily work?
6. Can you tell me about the feeling within the group during the Life4YOUth/MINISTOP trials?
7. What would you and your colleagues need to enable you to implement mHealth, such as Life4YOUth/MINISTOP?
8. Please share your thoughts about whether or not [name of the organization] has what is required to implement mHealth.
9. Please share your thoughts if there are any special considerations prior implementing mHealth, compared to other digital interventions.
10. Please share your thoughts about the future and the use of mHealth, such as Life4YOUth/MINISTOP.

Managers

1. Can you tell me about your professional role and work?
2. How does your organization currently work with mHealth?
3. How do you perceive the need for mHealth in child/school healthcare?
4. How do you perceive your and the child/school healthcare nurses' motivation to implement mHealth?
5. How have you and the child/school healthcare nurses proceeded to use the Life4YOUth/MINISTOP apps in the daily work?
6. How do you view your role as a manager when implementing new routines?
7. Can you tell me about the feeling within the group during the Life4YOUth/MINISTOP trials?
8. Please share your thoughts about whether [name of the organization] has what is required to implement mHealth.
9. Please share your thoughts if there are any special considerations prior implementing mHealth, compared to other digital interventions.
10. Please share your thoughts about the future and the use of mHealth, such as Life4YOUth/MINISTOP.

Policymakers

1. Can you tell me about your professional role and work?
2. What does mHealth mean to you?
3. Why was the decision to implement mHealth made?
4. How do you perceive the need for mHealth in child/school healthcare?
5. Please tell me about some mHealth tools that currently are used in [name of the organization].

6. Imagine child/school healthcare were to implement mHealth; please share your views on [name of the organization] insights into what is required to implement.
7. Please share your thoughts about whether or not [name of the organization] has what is required to implement mHealth.
8. Please share your thoughts if there are any special considerations prior implementing mHealth, compared to other digital interventions.

Appendix II

The E-Ready Questionnaire, Study II

Questionnaire for you as a child healthcare nurse, working at a child healthcare center that is implementing MINISTOP as a parental support tool to promote healthy lifestyle behaviours and prevent overweight and obesity among preschool children.

This questionnaire includes questions about your experience of MINISTOP, and the conditions at your child healthcare center to implement MINISTOP. When we say MINISTOP, we refer both to the app used by parents, and the child healthcare interface, used by you as a nurse.

You will now see a number of questions where we ask you to rate the conditions for implementing MINISTOP in your daily routines. Please answer each statement by selecting the option that best reflects your experience.

1. How do you perceive the **resources at your child healthcare center** to implement MINISTOP?

	Does not exist at all	Exist to a small extent	Exist to a fairly large extent	Exist to a large extent
a) Sufficient allocated time to implement MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Sufficient staff resources at the child healthcare center to implement MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Clear goals for how to implement MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Experience among colleagues at your child healthcare center in working with digital solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Experience among colleagues at your child healthcare center in implementing new work routines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f) Adequate competence to implement MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g) Sufficient support and guidance to adapt MINISTOP to your child healthcare center	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

h) Sufficient training to be able to use and work with MINISTOP

Comments:

2. How do you perceive your **own resources** to use MINISTOP in your work?

	Does not exist at all	Exist to a small extent	Exist to a fairly large extent	Exist to a large extent
a) Experience in working with digital solutions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Competency to work with MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Feeling comfortable working with MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

3. To what extent do you perceive your nearest **manager** ...

	Not at all	To some extent	Fairly large extent	Large extent
a) Communicates the need for implementing MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Encourages child healthcare staff to engage in activities to implement MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Takes an active role in implementing MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Clearly communicates with child healthcare staff how MINISTOP will be implemented	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

e) Has insights into how MINISTOP will influence status quo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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Comments:

4. To what extent do you perceive your **colleagues...**

	Not at all	To some extent	Fairly large extent	Large extent
a) Discuss how work routines need to change when implementing MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Discuss duties that need to be omitted when implementing MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Discuss new duties that needs to be done when implementing MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d) Work together to adapt current work routines to MINISTOP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e) Take collective responsibility for the implementation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

5. In what way do you think implementing MINISTOP will **impact on your daily routines** regarding...

	Considerably worse	Some what worse	Unchanged	Slightly better	Much better
a) Your ability to work in accordance with your values	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b) Your ability to exercise your professional role	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c) Your ability to offer high quality care	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

d) Your ability to manage all your work

c) How you think MINISTOP aligns with the current workflow at your workplace

Comments:

6. How do you perceive **attitudes** to implement MINISTOP at your child healthcare center?

Very negative Rather negative Rather positive Highly positive

a) Among colleagues

b) Your attitude

c) Your manager's attitude

Comments:

Appendix III

Interview guide, Study III

Students' influences

1. When I mention the word 'health', what thoughts come to your mind?
2. How do you usually maintain health?
3. How do you use digital tools to support your health?
4. What are your thoughts on using mobile apps to promote mental health?

Characteristics of the mobile app

5. What are your impressions of content and layout of the DSI?
6. How would you describe the DSI to a friend?

Contextual factors within and outside the school

7. What makes you want to use the DSI or other mobile apps which aim to promote mental health?

Strategies employed by the school to enhance adoption

8. Can you tell me about the efforts that have been made to raise awareness of the DSI?

Influences from the school healthcare nurse

9. Could you share your experience of when the school nurse recommended the DSI during the health visit?

Appendix IV

Interview guide, Study IV

Nurses

CFIR CONSTRUCT	QUESTION
INTERVENTION CHARACTERISTICS	
Intervention source	<ol style="list-style-type: none"> 1. In what kinds of situations or contexts have you heard about the DSI? 2. Could you tell me who developed the DSI, and what you know about its background? 3. Could you share what motivated your school to implement the DSI?
Evidence strength and quality	<ol style="list-style-type: none"> 4. What results or findings related to the DSI are you familiar with? 5. How important do you think it is for a tool to be evidence-informed?
Relative advantage	<ol style="list-style-type: none"> 6. What advantages or disadvantages do you see with the DSI compared to how you usually work to support students' mental health? 7. Could you share your experience of using digital tools in your daily work to promote student mental health?
Adaptability	<ol style="list-style-type: none"> 8. How would you describe your ability to adapt the DSI to make it effective during health visits?
Trialability	<ol style="list-style-type: none"> 9. Can you describe whether you felt it was important to pilot the DSI before implementing it in health visits?
Design quality and packaging	<ol style="list-style-type: none"> 10. What is your impression of the DSI's layout and design?
OUTER SETTING	
Students' needs and resources	<ol style="list-style-type: none"> 11. What needs do you observe among the students you work with? 12. How do you perceive DSI's ability to meet the needs of the students you encounter? 13. Can you describe any experiences students have shared with you about using the DSI?
Cosmopolitan	<ol style="list-style-type: none"> 14. Could you tell me about the most important professional networks you're part of outside your school? 15. How does your workplace encourage and support you in building professional networks outside of school? 16. Can you tell me about your opportunities to attend conferences or professional development courses?
Peer pressure	<ol style="list-style-type: none"> 17. Can you tell me about any other schools that have implemented the DSI and what you know about their experiences?

INNER SETTING

Structural characteristics	18. Could you tell me which educational profiles you are currently responsible for in your role as a school nurse?
	19. Approximately how many health visits do you carry out over the course of a typical year?
	20. Would you mind sharing about your current employment arrangement?
	21. How would you describe your schools' physical environment?
	22. We've just touched on some structural aspects of your school. In your view, how might these factors influence the implementation of new working methods?
Network and communications	23. Who would you say are your closest colleagues in your day-to-day work?
	24. Could you describe the different types of teams you are part of within the school?
	25. How would you describe your working relationships with colleagues in the school healthcare team?
	26. When you need to get something done or to solve a problem, who are your "go-to" people?
Culture	27. How would you describe the overall culture of your school?
	28. In your view, how does this culture influence the implementation of new changes or working methods?
Tension for change	29. How important do you think the DSI is to meet the needs of your school and students?
	30. In what ways do you see a need for digitalization and apps in your daily work?
Compatibility	31. In your experience, how does the DSI align with the mission of school healthcare services?
	32. How do you feel the DSI fits into your current routines during health visits?
Relative priority	33. If you're short on time during a health visit, how do you prioritize using the DSI?
Goals and feedback	34. Can you describe the goals your school has had for implementing the DSI?
Learning climate	35. To what extent do you feel that you are encouraged to try out new approaches to improve your work?
Leadership engagement	36. In your experience, how are principals typically involved when new changes are introduced in school healthcare services?
Available resources	37. How would you describe your access to resources, like time, training, or technology, needed to implement the DSI?
Access to knowledge and information	38. What kinds of materials or information have you engaged with so far regarding DSI?

CHARACTERISTICS OF THE INDIVIDUALS

Knowledge and beliefs about the intervention	39. What are your expectations for what the DSI can contribute to your work and to student health?
	40. What are your concerns or reservations about using the DSI?
Self-efficacy	41. How confident do you feel using the DSI during a health visit?
Individual stage of change	42. If you were to describe your current stage in learning to use the DSI during health visits, which of the following would best reflect your experience: You haven't started using it/ You feel like a beginner / You feel sufficiently confident / You are an expert?

Individual identification with organization	43. What drives you in your role as a school nurse?
PROCESS	
Planning	44. How did you prepare and plan for the implementation of the DSI at your school?
Opinion leaders	45. Can you describe any staff members or other individuals at the school who are actively supporting or leading the implementation of the DSI? 46. Which people at the school would you say have been important to involve in the implementation of the DSI?
Formally appointed internal implementation leaders	47. Can you tell me who you see as being responsible for leading the implementation of the DSI at your school?
Champions	48. Can you describe someone at the school who you feel is especially passionate about DSI and actively drives its implementation forward?
External change agents	49. Can you describe any units or individuals outside the school who support the implementation of the DSI?
Key stakeholders	50. What steps have been taken to encourage you and other school nurses to use the DSI during health visits?
Innovation participants	51. What has been done at the school to encourage students to use the DSI?
Reflecting and evaluating	52. As the implementation has progressed, how have you evaluated or followed up on how it is going?

Principals

CFIR CONSTRUCT	QUESTION
INTERVENTION CHARACTERISTICS	
Intervention source	1. Could you tell me what you know about the DSI?
Relative advantage	2. Could you share what motivated your school to implement the DSI? 3. What advantages or disadvantages do you see with the DSI compared to how your school usually works to support students' mental health? 4. What similar tools or working methods do you know of that are being used in schools or within school healthcare services to promote student mental health?
OUTER SETTING	
Students' needs and resources	5. What needs do you observe among the students you at your school? 6. Could you tell me how your school is working to promote students' mental health?
Cosmopolitan	7. How does your school encourage and support school nurses in building professional networks outside of school?

- | | |
|---------------|---|
| Peer pressure | 8. How are opportunities for school nurses to attend conferences or professional development courses organized or supported within your school? |
| | 9. Can you tell me about any other schools that have implemented the DSI and what you know about their experiences? |

INNER SETTING

- | | |
|----------------------------|--|
| Structural characteristics | 10. Approximately how many students are currently enrolled at your school? |
| | 11. Which educational programs are offered at your school? |
| | 12. Which programs and responsibilities are you personally in charge of? |
| | 13. How many school nurses are employed at your school? |
| | 14. What type of employment arrangements does the school nurses have? |
| | 15. How would you describe your schools' physical environment? |
| | 16. We've just touched on some structural aspects of your school. In your view, how might these factors influence the implementation of new working methods? |
| | 17. Who are the members of the school healthcare team at your school? |
| Network and communications | 18. Could you describe the different types of teams that the school nurses are involved in? |
| | 19. How would you describe working relationships with colleagues in the school healthcare team? |
| | 20. When you need to get something done or to solve a problem, who are your "go-to" people? |
| Culture | 21. How would you describe the overall culture of your school? |
| | 22. In your view, how does this culture influence the implementation of new changes or working methods? |
| Tension for change | 23. How important do you think the DSI is to meet the needs of your school and students? |
| | 24. In what ways do you see a need for digitalization and apps for health promotion work with students at your school? |
| Compatibility | 25. In your experience, how does the DSI align with the mission of school healthcare services? |
| Goals and feedback | 26. Can you describe the goals your school has had for implementing the DSI? |
| Learning climate | 27. Can you describe a change initiative or implementation that has been carried out within the school healthcare services? |
| | 28. To what extent do you feel you can reflect on current working methods within school healthcare services, and to consider new ways of working? |
| Leadership engagement | 29. Can you describe your role as a principal when a change initiative is carried out within school healthcare services? |
| | 30. Who would you say usually holds overall responsibility when a change initiative is carried out within school healthcare services? |
| | 31. Can you describe in what ways you have been involved in the implementation of the DSI? |

PROCESS

Planning	32.	How did you prepare and plan for the implementation of the DSI at your school?
Opinion leaders	33.	Can you describe any staff members or other individuals at the school who are actively supporting or leading the implementation of the DSI?
	34.	Which people at the school would you say have been important to involve in the implementation of DSI?
Formally appointed internal implementation leaders	35.	Can you tell me who you see as being responsible for leading the implementation of DSI at your school?
Champions	36.	Can you describe someone at the school who you feel is especially passionate about the DSI and actively drives its implementation forward?
External change agents	37.	Can you describe any units or individuals outside the school who support the implementation of the DSI?
Key stakeholders	38.	What steps have been taken to encourage you and other school nurses to use the DSI during health visits?
Reflecting and evaluating	39.	As the implementation has progressed, how have you evaluated or followed up on how it is going?

Papers

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